

2019

ANNUAL REPORT

Tanzania Urban Resilience Program

Credits

EDITORS

Darragh Coward
Edward Anderson
Eric Dickson

GRAPHIC DESIGN

Theresia Mmasi
Darragh Coward

PHOTOGRAPHY

Andrew Stephen
Chris Morgan

PRINTING

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Tanzania Urban Resilience Program 2019

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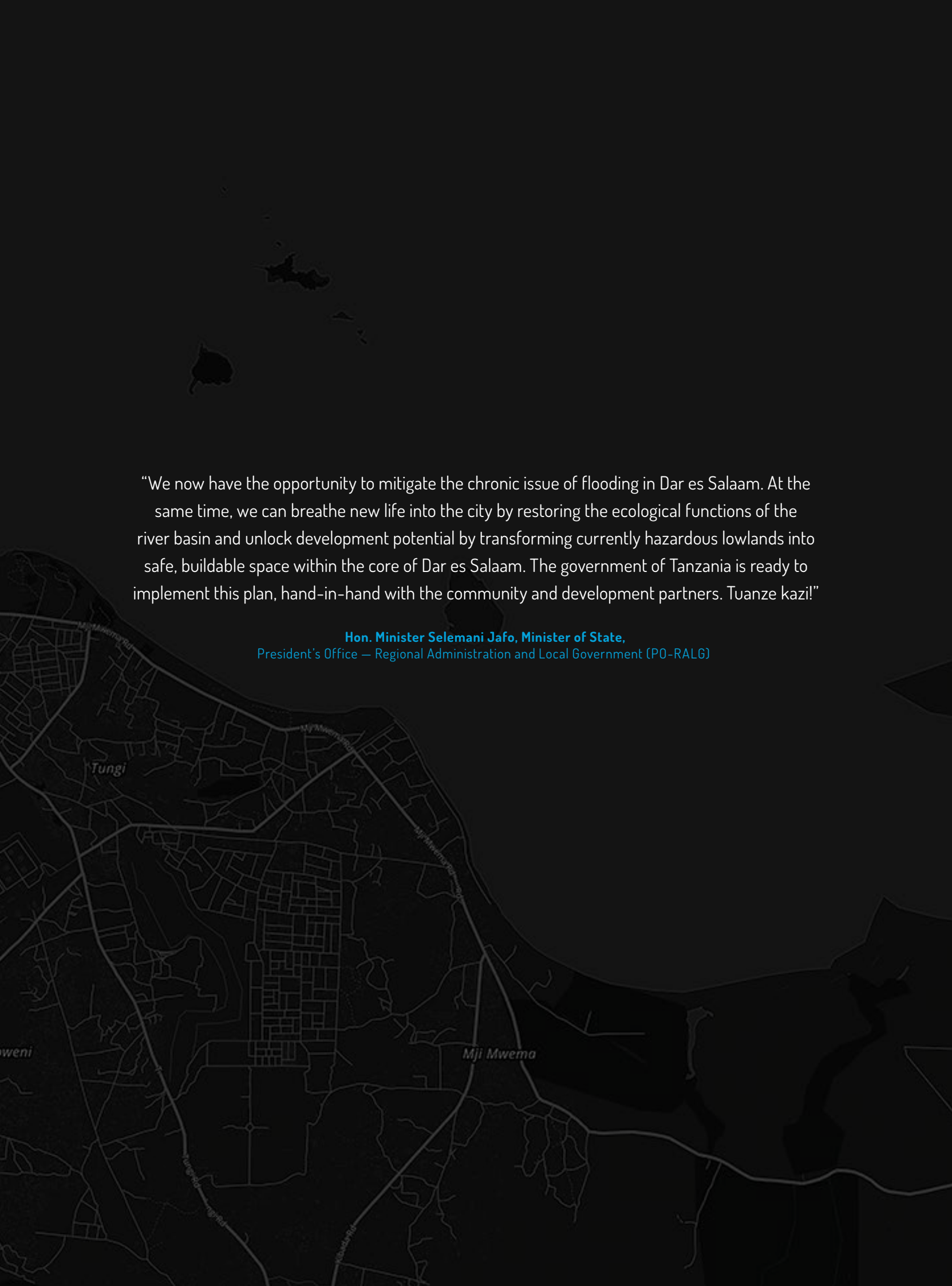
Tanzania Urban Resilience Program

Tanzania Urban Resilience Program (TURP) was established in 2016 from a partnership between the United Kingdom's Department for International Development (DFID) and the World Bank to support the Government of Tanzania in its endeavor to increase resilience to climate and disaster risk.



TANZANIA
URBAN RESILIENCE
PROGRAMME





“We now have the opportunity to mitigate the chronic issue of flooding in Dar es Salaam. At the same time, we can breathe new life into the city by restoring the ecological functions of the river basin and unlock development potential by transforming currently hazardous lowlands into safe, buildable space within the core of Dar es Salaam. The government of Tanzania is ready to implement this plan, hand-in-hand with the community and development partners. Tuanze kazi!”

Hon. Minister Selemani Jafo, Minister of State,
President’s Office — Regional Administration and Local Government (PO-RALG)

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Acronyms

AA	Administration Agreement	IPF	Investment Project Financing
AAL	Average Annual Loss	KPI	Key Performance Indicator
ACCA	Awareness, Comprehension, Commitment, Action	LiDAR	Light Detection and Ranging
ASA	Advisory Services and Analytics	M&E	Monitoring and Evaluation
BETF	Bank-Executed Trust Fund	MEO	Mtaa Executive Officer
BRT	Bus Rapid Transit	MKUKUTA-II	National Strategy for Growth and Poverty Reduction
CDPRP	Community Disaster Preparedness and Response Plan	MoU	Memorandum of Understanding
CDRT	Community Disaster Response Teams	MoWI	Ministry of Water and Irrigation
CERC	Contingency Emergency Management Component	MSMF	Msimbazi Strategic Management Framework
COP	Community of Practice	NEMC	National Environmental Management Council
COSTECH	Tanzania Commission for Science and Technology	OPM	Oxford Policy Management
CRRP	Community Risk Reduction Plan	PA	Programmatic Approach
CSO	Civil Society Organization	PDNA	Post-Disaster Needs Assessment
CTTL	Child Activity Task Team Leader	PO-RALG	President's Office – Regional Administration and Local Government
DarMAERT	Dar es Salaam Multi-Agency Emergency Response Team	RAS	Regional Administrative Secretary
DART	Dar es Salaam Rapid Transit Agency	RETF	Recipient-Executed Trust Fund
DEMs	Digital Elevation Models	RMI	Risk Management Index
DfID	United Kingdom's Department for International Development	SC	Steering Committee
DMD	Disaster Management Department	SOGDAT	Support to Open Data and Accountability in Tanzania
DRF	Disaster Risk Framework	SUZA	State University of Zanzibar
DRM	Disaster Risk Management	SWIFT	Survey of Well-being via Instant and Frequent Tracking
EMI	Earthquake Megacities Initiative	TAHMO	Trans-African Hydro-Meteorological Observatory
EMIS	Emergency Management Information System	TANROADS	Tanzania National Roads Agency
ESA	European Space Agency	TED	Training, Exercises, and Drills Program
EWS	Early Warning System	TF	Trust Fund
FY	Fiscal Year	TMA	Tanzanian Meteorological Agency
GA	Grant Agreements	TOR	Terms of Reference
GEO-ICT	Geographic Information and Communication Technologies	TRC	Tanzania Red Cross
GFDRR	Global Facility for Disaster Reduction and Recovery	TTL	Task Team Leader
GFR	Grant Financing Request	TURP	Tanzania Urban Resilience Programme
GIS	Geographic Information System	UAV	Unmanned Aerial Vehicle
GoT	The Government of Tanzania	UDSM	University of Dar es Salaam
GPSURR	Social, Urban, Rural, and Resilience Global Practice	ULGA	Urban Local Government Authority
ICLEI	Local Governments for Sustainability	UNA	Urban Natural Assets
IGAD	Inter-Governmental Authority on Development	USSD	Unstructured Supplementary Service Data
		UTEP	Urban Thematic Exploration Platform
		VICOBA	Village Community Banks
		WBG	World Bank Group
		WRBWB	WamiRuvu River Basin Water Board

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Executive Summary

A photograph of three men walking away from the camera, seen from behind. The man on the left wears a striped beanie and a plaid shirt. The man in the middle wears a white beanie and a plaid shirt. The man on the right wears a dark t-shirt and a shoulder bag. They are walking on a path that leads into the distance. The background is a solid blue color with abstract white geometric lines and shapes, suggesting a modern or technological theme.

01

Extreme weather events are becoming a global norm, with record heat, wildfires, and rainfall being reported on a regular basis. In Tanzania, this translates into severe flooding, exacerbated by climate change and environmental degradation. Rainfall in April and May of 2018 had an enormous impact on the country's growing urban population, with the destruction of critical infrastructure, the displacement of thousands, and several fatalities reported.

Research conducted by the Tanzania Urban Resilience Program (TURP) on this period finds that the economic toll in Dar es Salaam alone reached upwards of USD \$100 million, close to 2% of the city's gross domestic product (GDP). According to trends, the frequency of these events will only increase with time if coordinated measures are not taken. This underscores the urgent need to build resilience and mitigate risk moving forward, and further emphasizes the importance of TURP in responding to the expectations of citizens and Government stakeholders alike.

Projects remained consistently active over the 2019 Fiscal Year (FY). Between July 2018 and June 2019, USD \$3,822,000 of program funding, provided by the United Kingdom's Department for International Development (DfID), was disbursed or committed across the 18 contracts under TURP's four pillars of implementation: Pillar 1 – Risk Identification, Pillar 2 – Risk Reduction, Pillar 3 – Emergency Preparedness, and Pillar 4 – Resilience Academy.

Pillar 1, which focuses on innovative methods for the collection and dissemination of actionable climate risk data, continued to inform risk reduction and response measures this FY. A priority was put on informative assessments guiding redevelopment of the Msimbazi River Basin, Dar es Salaam's most

flood-prone area that is home to over 25% of the city's population. These assessments were made possible with support from Ramani Huria, Swahili for "Open Map," an initiative that has now equipped over 1,000 Tanzanian students and community members with critical skills in participatory mapping methods. During FY19, Ramani Huria collected a new and critical dataset used to identify and analyze risk – from drainage points, to soil samples, to solid waste hotspots – and, during times of emergency, the initiative once again responded with a rapid assessment of its own, mapping the impact of severe flooding across Dar es Salaam.





The 3 Pillars + Resilience Academy



PILLAR 1

Data Collection for Risk Identification



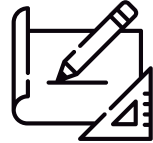
PILLAR 2

Planning for Risk Reduction



PILLAR 3

Emergency Management and Preparedness



RESILIENCE ACADEMY

Scientific Tools and Models for Risk Management

Pillar 2, designed to fill gaps in the planning and coordination of risk-reduction activities in Tanzania, delivered new insights and community engagements in FY19. Two socioeconomic studies were concluded, shedding light on the tolls of flooding on impoverished communities as well as the community-level coping mechanisms in place. These community-driven research pieces were complemented by support for ward-level government disaster committees through development of Community Risk Reduction Plans (CRRPs). These plans serve to standardize community action for improved flood mitigation, and the engagement and planning process also serves to convene and activate disaster management committees for the first time. Such action was also enabled by TURP through the Let's Do It World Cleanup Day – an awareness-raising campaign that put solid waste management at the forefront of the dialogue on resilient urban development and engaged over 26,000 community members in a country-wide clean-up.

As TURP passes its mid-point, much of the program attention has been put on sustainability of knowledge and systems and hence, on Pillar 4, the Resilience Academy.

Another major highlight from Pillar 2 was the release of the Msimbazi Opportunity Plan, which aims to guide national intervention for risk reduction with a comprehensive strategy for addressing Dar es Salaam's most flood-prone area, the Msimbazi River Basin. The plan, conceptualized through a participatory process, attained the support of several government ministries in FY19, which are now actively rallying to secure funding for implementation.





Activities under Pillar 3, which is dedicated to improving emergency management across the country, built response capacity and installed standardized systems in FY19. Several trainings were delivered to better prepare the Dar es Salaam Multi-Agency Emergency Response Team (DarMAERT) for the event of disaster, and an Emergency Management Information System (EMIS) was prototyped and tested to digitally streamline the organization's operations. At a community level, TURP also provided support to ward-level government under this Pillar in the co-creation of Community Disaster Response Plans (CRDPs), piloted in three wards, which are intended to support effective local response to emergency.

As TURP passes its mid-point, much of the program attention has been put on sustainability of knowledge and systems and hence, on Pillar 4, the Resilience Academy. This Pillar aims to curate and transfer data, tools, and models of the program into a local academic and technical platform. Leaders representing four Tanzanian universities and one international institution

were quick to set the goals of the Resilience Academy and mobilize from planning into action. Early outputs from their collaborative efforts have included the development of a Climate Risk Database for risk information, the structuring of eight academic modules for risk education in planning, and the institutionalization of an industrial training program. These outputs now serve as the foundation for a digital hub of educational resources, training, and exchange related to urban resilience — soon to become available at resilienceacademy.ac.tz.

Looking ahead, the program anticipates the potential for another devastating rainy season and is striving to operationalize the new plans at local level, as well as build awareness of the benefits and flood protection impact of the Msimbazi Opportunity Plan. Activities in Dar es Salaam are expected to focus on supporting operational needs and taking onboard long-term sustainability considerations. In addition, work on urban resilience is expected to scale up in select secondary cities and Zanzibar.

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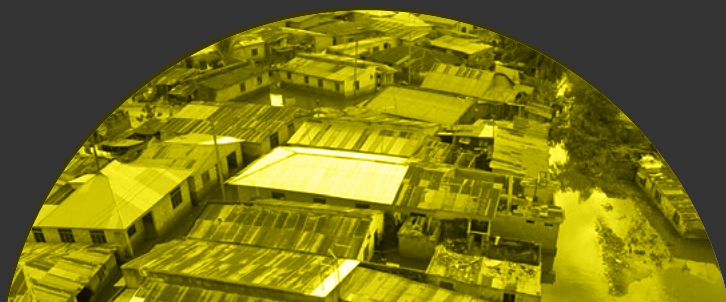
By the Numbers

02



Highlights

▾ Pillar 1 Risk Identification



700+ KILOMETERS OF DRAINAGE SEGMENTS AND POINTS MAPPED

8,000 DATA POINTS COLLECTED FOR WASTE COLLECTION



675,000+ BUILDING FOOTPRINTS DIGITIZED

5,705 AMENITIES MAPPED

02 FLOOD EVENTS MAPPED FOR IMPACT AND RESPONSE

01 GEOMORPHOLOGY ASSESSMENT CONDUCTED

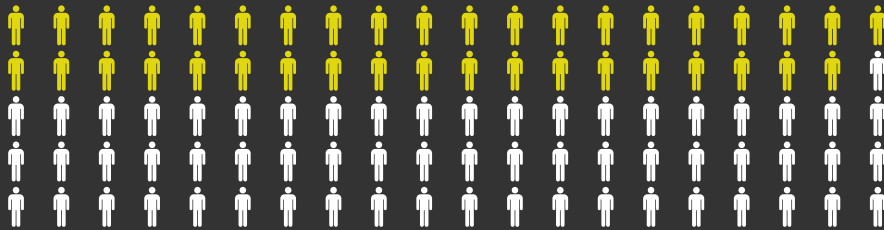


20,000+ TRASH HOTSPOTS IDENTIFIED FOR CLEAN-UP



643 SOIL SAMPLES COLLECTED AND ANALYZED

➤ Pillar 2 Risk Reduction



39%

OF THE POPULATION
(2 MILLION PEOPLE) IDENTIFIED
AS IMPACTED BY FLOODING



USD \$100m

LOSSES RECORDED FROM
1 MAJOR FLOOD EVENT



500,000+

KILOGRAMS OF
WASTE REMOVED

02 SOCIOECONOMIC STUDIES CONDUCTED

01 STRATEGIC PLAN FOR THE MSIMBAZI
SUPPORTED BY MINISTRY LEADERS



26,000+

PARTICIPANTS IN 102 SOLID
WASTE CLEAN-UPS

USD \$114m ESTIMATED FOR
MSIMBAZI UPGRADING

➤ Pillar 3 Emergency Management



50

EMERGENCY SHELTERS AND
2 WAREHOUSES IDENTIFIED

01

DIGITIZED ONTO EMERGENCY
MANAGEMENT INFORMATION
SYSTEM (EMIS)



04

EMERGENCY RESPONSE TRAINING
MODULES DEVELOPED
– 1 DELIVERED

04

TECHNICAL TRAININGS DELIVERED ON
EMIS



Pillar 4 Resilience Academy



500+

STUDENTS TRAINED ON
PARTICIPATORY MAPPING
METHODS



45

DATASETS UPLOADED
TO THE CLIMATE RISK
DATABASE (CRD)



05

UNIVERSITIES ENGAGED
IN PARTNERSHIP

08

ACADEMIC MODULES IN
CO-DEVELOPMENT

50

UNIVERSITY COURSES
TARGETED FOR RESILIENCE
LEARNING MATERIAL

150

STUDENTS FROM 3 UNIVERSITIES
SELECTED FOR 2 INTERNSHIP/
INDUSTRIAL TRAINING PROGRAMS

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About TURP





Tanzania is the most flood-affected country in East Africa, and also home to some of the fastest-growing cities on the continent. Currently in its third year of implementation, TURP's overall objective is to support national and local governments of Tanzania in strengthening management of climate risk in these cities and enabling climate-resilient urbanization across the country.

The program, a partnership between the World Bank Group (WBG), the Government of Tanzania (GoT), and DfID, is structured to improve risk identification, systems planning for risk reduction, and coordination and emergency management activities, positioning TURP in close alignment with Sustainable Development Goal 11 to “make cities and human settlements inclusive, safe, resilient, and sustainable.”¹

Higher-level objectives to which the program contributes include:

Increasing Resilience to Climate and Disaster Risk

TURP supports the Government of Tanzania (GoT) in implementing a program that promotes climate and disaster risk management in the wider context of sustainable development. The proposed engagement is aligned with and directly addresses the government's priorities on growth, the environment, and climate adaptation outlined in the second National Strategy for Growth and Poverty Reduction (known as MKUKUTA-II, Mkakati wa Kukuza Uchumi na Kupunguza

¹ <https://www.un.org/sustainabledevelopment/cities/>

Umaskini Tanzania). Similarly, the activities directly support the strategic objectives and interventions in the National Climate Change Strategy, Zanzibar Climate Change Strategy, and Disaster Management Act 2015.

Promoting Shared Prosperity and Ending Extreme Poverty

Climate change and adverse natural events have the greatest impact on the poorest populations who generally live in higher-risk areas and have a diminished capacity to recover from disaster. In the case of Tanzania, even frequent, low-intensity events such as a heavy rainfall can have crippling and cumulative effects on livelihoods and communities of the bottom 40%. Impediments to development gains as a result of climate hazards that particularly impact the poorest communities can be minimized by reducing the exposure to hazardous events and decreasing the vulnerability of the poor to climate disturbances.

These are the core challenges being addressed by TURP through a systematic mainstreaming of risk management principles across government and civil society.

In the initial years, TURP worked through a structure of three Pillars to effectively foster engagement and dialogue surrounding urban resilience. These Pillars were: (1) Risk Identification, (2) Risk Reduction, and (3) Emergency Preparedness. Last year, following stakeholder feedback and consultation, activities dedicated to skills transfer, research, and capacity building grew into a stand-alone fourth Pillar: (4) the Resilience Academy. A steering committee, composed of key stakeholders from the Prime Minister's Office – i.e., Disaster Management Department (DMD), the President's Office – Regional Administration and Local Government (PO-RALG), DfID, WBG have overseen the implementation projects that fall under these Pillars, with advice from the Technical Advisory Committee, composed of a broader set of program stakeholders and government agencies.

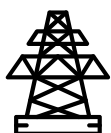
TURP Challenges



LACK OF DATA
AND INFORMATION



INADEQUACY OF URBAN AND
LAND USE PLANING SYSTEMS



SIGNIFICANT AND GROWING,
INFRASTRUCTURE GAP





Distribution of TURP Project Pillar Funds in Fiscal Year 2019



● 35% PILLAR 1

● 31% PILLAR 2

● 19% PILLAR 3

● 15% RESILIENCE ACADEMY

Description of Program Activities

The following is an overview of activities supported by WBG through the TURP Trust Fund (TF):

(A) PILLAR 1 – RISK IDENTIFICATION

This Pillar strengthens the identification and understanding of climate risk and uncertainty in the local context and enhances the linkages and coordination between risk-management stakeholders. To make decisions that ultimately strengthen physical, social, and financial resilience, a thorough understanding of disaster and climate risks in the local context and their implications is vital. This informs decision makers about the risks they face and the drivers of those risks. As such, Pillar 1 increases access to

comprehensive information about physical and societal exposure to climate risks, which inform implementation of structural and non-structural mitigation measures.

Key activities in this Pillar are the collection and organization of climate risk data as well as the development of visualization tools and risk models. Socioeconomic data include the mapping of people, assets such as houses or critical infrastructure, and urban services and livelihoods. Environmental data and models include the historical data and current monitoring of hydro-meteorological phenomena, the geophysical characteristics of the urban environment such as soil types, land use, and river basin profiles, and application of the best climate models to identify future impacts of climate change.

(B) PILLAR 2 – RISK REDUCTION

Guided by the data and management tools of Pillar 1, Pillar 2 functions to strengthen cities' capacity to plan for and reduce climate risk through the use of both structural and non-structural measures addressing long-term systemic risk. In partnership with government entities, civil society, and the private sector, activities that Pillar 2 support focus on the reduction of the vulnerability of people, households, and communities. This is accomplished by providing analysis of non-structural measures, such as creating or improving policies and legislation, better land use planning, environmental protection and basin plans, hazard zoning and building codes, and the design of risk-reduction works, such as drainage upgrades, ponding schemes, slope stabilization, and retrofitting or reinforcement programs.

The activities support communities, planning, and works authorities with the development of

a pipeline of investments reducing urban risk. These investments support the resilience of critical infrastructure, and specifically target measures aimed at protecting priority river basins and improving flood management infrastructure.

(C) PILLAR 3 – DISASTER PREPAREDNESS AND EMERGENCY MANAGEMENT

Pillar 3 supports all stakeholders involved with short-term disaster events and preparedness for specific emergency scenarios. Also guided by Pillar 1 data, Pillar 3-collected scenarios of city risk will be used to establish best practices around identifying and preparing vulnerable groups, emergency response plans, and an operations center; design of Early Warning Systems (EWSs); requirements for equipment, tools, and infrastructure; and simulations, drills, and damage assessment capacities. Stakeholders in this workstream are concerned with civil protection, disaster management, community volunteers, coordination for response, and recovery actions.





(D) PILLAR 4 – RESILIENCE ACADEMY

Thematic content of the Resilience Academy is embedded as a knowledge-transfer function within the activities of Pillars 1 through 3.

The concept of the Resilience Academy is as an evolving virtual program anchored in Tanzanian universities and training institutes that delivers digital curricula, practical experience, training placements and courses, and equipment to support surveying, maintenance, risk monitoring, and analysis activities.

The goals are to enable a legacy for skills and tools developed through TURP and build partnerships between academia and practitioners that enhance the sustainability of risk-management practices and datasets in Tanzania.

Key activities are the transfer of datasets and risk analysis tools to university programs, as well as leveraging the yearly placement in industry program to provide university students with real-world experience in collecting, analyzing, and applying risk data.

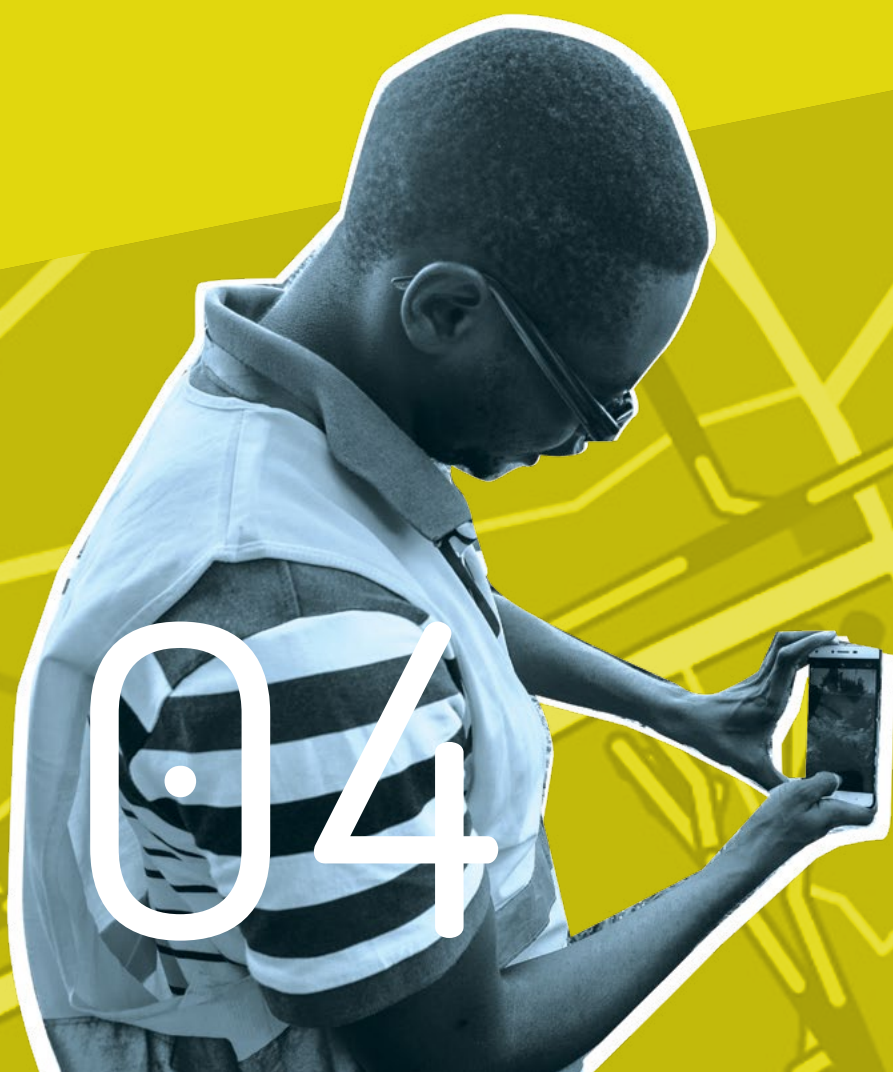
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In addition to World Bank-executed activities, TURP anticipates that it will provide financial support for government implementation of activities designed to (i) mainstream and scale up climate risk management practices, including community-driven works, projects, and small grants; and (ii) introduce green urban investments for flood risk reduction, basin management, drainage enhancements, and EWSs. A key focus has been to support the GoT's Flood Management Task Force's call to address flooding in the Dar es Salaam City Center through a Msimbazi River Flood Risk Reduction project and development of a Msimbazi Basin Flood Management Framework.

Implementation of these GoT-executed activities is subject to grant agreements being signed with the Ministry of Finance, and reporting will be done separately from this Annual Report.

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Activity Summary





Pillar 1

Risk Identification



OBJECTIVE

To strengthen the identification and understanding of climate risk and uncertainty in the local context.

OVERVIEW OF PROGRESS

Activities under Pillar 1 continued to play an important role over the course of FY19. Data

collection activities have been ongoing and critical assessments have been conducted to produce a more comprehensive image of risk in Tanzania.

Many of the outputs from these activities are now informing implementation of risk-reduction and emergency preparedness measures, and the innovative techniques and methods used are being adopted into an educational platform under development in the Resilience Academy.



ACTIVITY	STATUS	PROGRESS
Elevation Model and Exposure Mapping	COMPLETED	<p>Light Detection and Ranging (LiDAR) acquisition of terrain elevation was conducted to produce Digital Terrain Models (DTMs) for the Msimbazi River Basin, – informing the Detailed Area Plan</p> <p>Mapping surveys of high-risk rivers were conducted in April 2019 and are expected to continue with a focus on sediment volumes – datasets available on government GoT and university map portals with appropriate licensing</p>
Erosion and Sedimentation Study	COMPLETED	<p>Study completed and data analyzed – outputs suggest that there will be a continued increase in the rates of erosion, soil loss, and sedimentation with time and urban development – advising quick preventative action to be taken in the Msimbazi</p>
Community Mapping – Ramani Huria	FINALIZING	<p>An unprecedented amount of data has been collected, including information on: soil sediment sampling data, city drainage data, hyper-local boundaries data, assets and threats data for flood risk identification, city trash hotspots data for waste management, flood response data for damage assessment, and building footprint digitization</p> <p>Now curating, organizing, documenting, and publishing the data, tools, and knowledge created through project implementation for handover to the Resilience Academy</p>
Historical Events Inventory	INITIAL STAGES	<p>This activity is foreseen for FY20 - discussion on scope and methodology to be determined</p>
Dar es Salaam Probabilistic Flood Risk Evaluation	INITIAL STAGES	<p>Over 50 firms applied to Expression of Interest and short list of 6 has been sent a Request for Proposals, – with tender expected to be given in FY20</p>
Risk Management Index & Updates	ONGOING	<p>Two field investigations have been conducted by the Earthquakes and Megacities Initiative (EMI) and a draft Disaster Risk Management Index (DRMI) toolkit with indicators has been delivered</p>
Hydrological Study and Monitoring	ONGOING	<p>Data collection for Msimbazi model calibration is complete. Work is now focused on two goals: ongoing river monitoring for model fine-tuning; and testing and validation of the TAHMO network in support of operational river flow forecasts</p>
Spatial Data Management and Hosting	ONGOING	<p>Transition and documentation of core data layers on risk information from Ramani Huria and Tanzania Commission for Science and Technology (COSTECH) Geonodes into a Climate Risk Database hosted by Tanzania Urban Resilience Academy; creation of a Data Flow Map underway</p>

HISTORICAL EVENTS INVENTORY

In order to accurately identify risks that have been posed in the past, the GoT has initiated a preliminary analysis of historical disaster events using the DesInventar methodology². TURP is currently reviewing how to support this effort while maintaining the focus on urban events.

² <https://www.desinventar.net/>

RISK MANAGEMENT INDEX & UPDATES

A gap in risk information inhibiting Tanzania's ability to reduce vulnerability, as well as to prepare for and recover from disaster, has been the absence of a national Disaster Risk Management Index (DRMI), which is a tool that outlines indicators related to the risk management performance of a country.

These indicators are established to reflect the organizational, development, capacity, and institutional action that guide a country's emergency management systems.

In response to this, TURP engaged the services of the EMI in FY19 to develop and apply a DRMI in the Dar es Salaam Region. Over the course of two field investigations, EMI took stock of the existing situation, evaluated and validated the draft DRMI indicators and toolkit, and collected inputs for adjustments to project implementation.

Beyond the baseline assessment of a toolkit, this project aims to ensure that progress is tracked along indicators, a roadmap is set in place to help stakeholders understand their status of implementation, and a training program is

delivered to key government institutions on the implementation and customization of the toolkit for further applications.

Beyond the baseline assessment of a toolkit, this project aims to ensure that progress is tracked along indicators, a roadmap is set in place to help stakeholders understand their status of implementation, and a training program is delivered to key government institutions on the implementation and customization of the toolkit for further applications.

“This project is a big opportunity to us because of the open forum and experience sharing amongst municipalities and with different organizations”

- Sweetbertha Paschal, Municipal Disaster Coordinator, Temeke Municipal Council





LiDAR surveys have overcome obstacles preventing the production of accurate DTMs for the challenging terrain of the Msimbazi. Photo credit: Chris Morgan

ELEVATION MODEL AND EXPOSURE MAPPING

DTMs are critical tools for effective mapping of flood hazards, providing detailed terrain typology, identifying flood plains, and indicating which infrastructure is most at risk. Developing DTMs from Digital Surface Models (DSMs) created by photogrammetry is possible, but very challenging for areas with dense vegetation cover or that are not easily accessible for establishing Ground Control Points (GCPs). Comprised of low-lying flood plains covered by tall grasses and dense mangrove vegetation, the Lower Msimbazi Basin is one such area.

Traditionally, aerial LiDAR systems of acquisition have been proven as the best method for capturing terrain elevation and deriving high-quality DTMs in challenging areas, but manned aerial flights are expensive, complex, and time-consuming. Therefore, in FY19, in line with the innovative methods of data collection conducted by the TURP, a drone equipped with a LiDAR



system connected to ground-independent positioning systems (RTK-GNSS and INS) was used to capture terrain elevation of the Msimbazi's Detailed Area Plan, an area identified for initial intervention by the Msimbazi Charrette Process.

The results from this survey secured accuracy not achievable using past surveys, with a substantial impact being noted in the difference. TURP's initiative has thus enabled a rigorous comparison of DTM generation through different unmanned aerial vehicle (UAV) methods of acquisition, as well as a generation of reliable, accurate, fit-for-purpose data critical for the next phases of spatial development in the Msimbazi.

COMMUNITY MAPPING

The Ramani Huria project, a community mapping initiative led by the Humanitarian OpenStreetMap Team and adopted into the TURP portfolio, has been collecting localized data to improve urban resilience since its inception in 2015.

Over this time, thousands of students and community members have been equipped with knowledge and skills critical for conducting accurate risk mapping, and a substantial collection of datasets have been acquired through their involvement through community mapping activities. During the past fiscal year, continued engagement in drainage mapping resulted in total coverage of over 700,000 km (or 40 wards of Dar es Salaam) of drain points and segments. Ramani Huria-led building footprint digitization additionally captured a total of over 670,000 buildings within 28 of these wards, and asset and threat mapping enabled over 5,000 critical service amenities to be identified across the city. Project activities introduced in 2019 aimed further, to extend project impact and develop use cases for the data collected by the Ramani Huria team.

Over the months of October and November 2018, Ramani Huria and JBA Consulting partnered to develop a surface soil sediment dataset for the greater Dar es Salaam region of Tanzania,

intended to support a geomorphological assessment, taking into account soil sediment characteristics for erosion and flood risk studies. Although a national-level soil profile had existed for Tanzania prior to this effort, it contained only a single sample from Dar es Salaam — insufficient for analyzing the true potential of erosion across the city. A team of 10 field mappers and 4 office technicians — all Tanzanian youth participants of the Ramani Huria project — were trained in sample collection and analysis for this initiative, and a total of 643 points were ultimately sampled and analyzed for density. The resulting dataset, a geo-referenced set of soil sediment profiles (a soil map), has now been published and is available as open data. It is expected that this map will inform intervention for risk reduction in the Msimbazi River Basin.

“Our work in community mapping has showed the relationship between urban flooding and unregulated waste disposal. Solid waste often blocks the city’s already poorly maintained drainage systems, which leads to the regular flooding during rainy season. We are happy to now be working with organizations who want to address this correlation in their work.”

– Emanuel Kombe, Mapping Supervisor, Ramani Huria

Ramani Huria also partnered this fiscal year with two trash collection companies: Green WastePro Ltd, operating in formal settlements in the city center, and Joshemi Company Ltd, operating in informal settlements in Tabata Ward. By providing these companies with digital datasets, they are now able to track their clients, improve the sanitary conditions of neighborhoods, and help to reduce the risk of flooding across the city.

Further addressing the issue of solid waste in Dar es Salaam, Ramani Huria joined forces with Nipe Fagio in 2018 to map trash sites in Dar es Salaam. In just four days of mapping, 540 students collected and uploaded a total of 20,392 trash points. The mapped data helped to identify the

location of the areas with poorly managed waste materials, as well as the type and size of waste, and guided clean-up methods for a major clean-up of the city on September 15, 2018.

The trash hotspots were reduced to 9,452 after clean-up activities.

In response to heavy rainfall in March and May of 2019, which resulted in heavy flooding across Dar es Salaam, the Ramani Huria team additionally conducted rapid assessments and produced impact maps for high-risk sub-wards. These maps have provided community leaders with up-to-date information on risk for improved flood mitigation and response.

As the project nears its end, the Ramani Huria team has been working to curate, organize, document, and publish project data, tools, and knowledge in order to ensure sustainability of impacts through a handover to the Resilience Academy.



Thousands of students have now been trained on participatory mapping methods by Ramani Huria. Photo credit: Chris Morgan



Ramani Huria

LINK www.hramanihuria.org



18,350 DRAIN SEGMENTED AND
13,385 DRAIN POINTS MAPPED
IN 40 WARDS, COVERING OVER
700,000KM2



643 FIELD POINTS VISITED WITHIN
MUNICIPALITIES, RESULTING IN
1,286 TOP AND BOTTOM SOIL
SAMPLES COLLECTED



675,000 BUILDINGS REDIGITIZED
IN 28 WARDS

49 WARDS (AND 256 SUB-WARDS)
COVERED IN ASSET AND
THREAT MAPPING

5705 AMENITIES
MAPPED

8,000+ DATA POINTS COLLECTED FOR
TRASH COLLECTION IN
FORMAL AND INFORMAL
SETTLEMENTS

3,225 HYPERLOCAL BOUNDARIES
MAPPED IN 42 WARDS



Spotlight Story

Citizen Scientists Reduce Flood Risk with Soil Sampling

LINK <https://www.worldbank.org/en/news/feature/2019/05/15/in-tanzania-citizen-scientists-help-reduce-flood-risk-with-soil-sampling>





| 16 members of the Ramani Huria team were involved in soil sampling. Photo credit: Chris Morgan.



During the first few months of each year in Tanzania, the mood around urban centers like Dar es Salaam is one of dread due to the impending arrival of the rainy season. Around this time, headlines report a toll of losses related to flooding — of assets, of critical infrastructure, and of life.

Recent World Bank studies have identified many contributing factors to the increasing impact of flooding in Dar es Salaam. Soil erosion, historically under-addressed, plays a major role. Plaguing the Msimbazi River Basin that snakes through the city's center, soil erosion enables water to escape the confines of the river's natural borders. It also produces sediment, which obstructs river flow and increases flooding over time. This has disastrous effects on settlements along the riverbanks — many of which are informal and low-income. Community-led efforts to reinforce the collapsing riverbanks have involved the intentional dumping of solid waste, a makeshift solution that has further exacerbated the issue.

To analyze the extent of erosion along the river and better visualize the impact of potential interventions, TURP is conducting flood modelling for the city. With accurate flood models, decision makers will be better able to design sustainable solutions for the basin. However, experts have noted that modelling accuracy has been hindered by an outdated soil map.

"Flood modelling has not often shown the whole story for Dar es Salaam, as the soil map does not reflect the impact of urbanization," said Mussa Natty, an engineer and former municipal director supporting program activities. "Only one general soil type has been considered by decision makers in the past, and this severely limits accuracy of analysis as it doesn't account for how soil in different areas reacts differently to water."

Traditional programs would have employed costly international expertise to fill this data gap. Advocating instead for the adoption of affordable and local solutions to flooding in Dar es Salaam, the World Bank's Urban Resilience team is using citizen science for the task. A team of 16 young professionals and students leads the initiative, adopting open web applications and simple measurement tools for the physical collection of samples. These samples have been gathered from 643 strategic points across the city, covering an area of over 2,752km².

"The process demands that we test soils from

different areas around Dar es Salaam in order to determine the different soil profiles, which will ultimately help us understand how water will affect each soil type,” said Sia Salonga, one of the young samplers engaged in the project. “These profiles show us which areas are most susceptible to erosion, which are experiencing the most erosion, and how this influences flooding and river dynamics,” added Natty.

“Flooding is a reality for us all in Tanzania,” said Salonga. “I’m very grateful for the opportunity to participate in an initiative that will help leaders make informed decisions for our communities.”

After just two months of sampling, the team has recorded over 600 different soil types across the city, providing data that has been made open and free for public use. The resulting soil map will inform a comprehensive sedimentation study of Dar es Salaam, and the actions that need to be

taken regarding urban development around the Msimbazi River.

“We can see where some tree planting will be needed. Maybe we need to add in some grassy areas, or stop some urban development because certain areas are really susceptible to high erosion rates. These are some of the things we can consider with this data,” said Natty. As use cases emerge, this project aims to prove that critical disaster risk data collection does not have to be outsourced, that local knowledge and tools can support successful and sustainable solutions, and the capacities of young, aspiring practitioners can be nurtured in the process.

“Flooding is a reality for us all in Tanzania,” said Salonga. “I’m very grateful for the opportunity to participate in an initiative that will help leaders make informed decisions for our communities.”



| Ramani Huria team taking soil samples. Photo credit: Chris Morgan.

Erosion and Sedimentation study



43 SOIL SAMPLES TAKEN BY **16** STUDENT MAPPERS COVERING AN AREA OF **2,700KM²**

All 7 basins

COVERING CITY OF DAR ES SALAAM
BROKEN DOWN TO SUB-BASIN LEVELS

EROSION SUSCEPTIBILITY AND RATE
OF SOIL LOSS MAPS CREATED FOR
EACH BASIN SUB-DIVIDED

In recognition of the impact of erosion and sedimentation on flood dynamics in Dar es Salaam, TURP conducted a comprehensive geomorphological assessment during FY19, building upon data collected by the soil sampling initiative of Ramani Huria. This assessment provides a geomorphological perspective on the hydrological and hydraulic processes within the river basins of the city and sets out a plan to assess, manage, monitor, reduce, and control sediment flows in the short and long term.

The study has identified that the river basins within Dar es Salaam currently suffer from an imbalance of sediment — a state in which more sediment enters than leaves each system, predominantly a result of vegetation clearance over many years and rapid urbanization.

Analysis has also indicated that during peak flood conditions within the Lower Msimbazi, sediment transport rates could exceed 100 kg per second. The results from the outline assessment match the observed effects and the problems encountered with siltation of channels and flood plains in the lower reaches of the catchment.

The outputs of this study emphasize that if no action is taken, this will result in a continued increase in the rates of erosion and soil loss upstream and sedimentation in lower basins with future urban development, which will altogether increase the frequency and severity of flood events and overall flood risk. The existing erosion and sedimentation problems will continue until long-term solutions are implemented and established to reduce sediment entering the river.

Therefore, the study has directly identified the sub-basins at risk of erosion and enabled development of a strategic plan to reduce erosion in the long term.





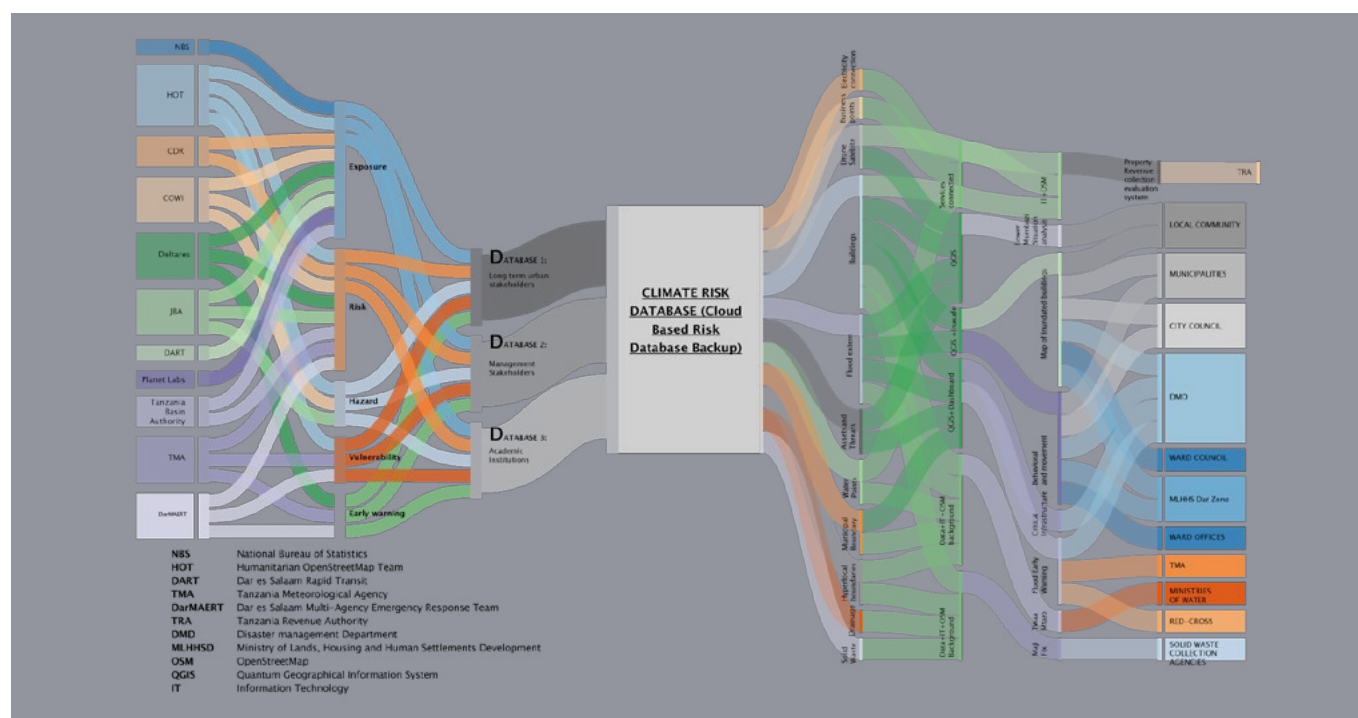
| DMDP Weather station installation under TURP. Photo credit: Chris Morgan.

HYDROLOGICAL STUDY AND MONITORING

To increase the monitoring capacity of the DMD (under the Prime Minister's Office) and the Ministry of Water and Irrigation (MoWI) of the GoT, TURP contracted Delft University of Technology to demonstrate and deploy TAHMO instruments. The direct goal of these stations is to accurately monitor the weather and its spatial variability, while the ultimate goals are to i) use these observations for set-up and fine-tuning of hydrological models of the basin, and ii) use the stations to operationally forecast river flows and downstream impacts within the city of Dar es Salaam through a forecasting system.

Activities carried out within the project for this FY include the following:

- Training of staff of Wami-Ruvu River Basin office and teachers in Dar es Salaam on station installation, operation, and maintenance
- Building a preliminary hydrological forecast shell set-up for the operational data feeds of the TAHMO station network and satellites
- Creating a preliminary hydrological rainfall run-off model that simulates rainfall run-off response of the Mzimbaizi catchment done in collaboration with the Community Water Watch project
- Automating forecast workflows to update the system and run forecasts using the aforementioned data feeds
- Using a geographic information system (GIS)-based portal to inspect ingested data and results of forecasts (flows, water levels) spatially as well as at specific forecast locations done in collaboration with the Community Water Watch Project
- Training local and international MSc students on flood modelling and EWS set-up
- Setting-up a use case for flood EWS for bus rapid transit (BRT) in Dar es Salaam.
- Maintaining the hydro-meteorological equipment installed under TURP



Data Flow Map of Resilience Academy

A flood EWS portal or dashboard was successfully developed to support this work in collaboration with the Community Water Watch project. The portal is intended as a demonstration site; it is, however, functional and accessible on <https://dashboard-dar.floodtags.com/>. A use case for the BRT has already been set up, and others are soon to arise (e.g., for the Tanzania Red Cross Society [TRCS]). The dashboard's public launch is planned for October 2019.

Official validation process is expected to take the form of a co-location of TAHMO station with the Tanzania Meteorological Agency (TMA) "standard" station. The co-location should be completed by December 2019.

SPATIAL DATA MANAGEMENT AND HOSTING

Risk data assets that have been collected through TURP thus far have undergone a cataloging exercise conducted by members of the Resilience Academy team. This process preceded the

populating of the Climate Risk Database (CRD) during FY19 and developed it into a geonode format. Assets incorporated into the geonode include existing and planned exposure, hazard, risk, and socioeconomic data, useful for any researchers or practitioners working in the field of urban resilience. The CRD is now discoverable at: <https://geonode.resilienceacademy.ac.tz>, but will soon be added to the RA website as a more centralized digital platform for all RA resources.

This database has informed the first version of the Resilience Academy data flow map, which aims to identify data collectors and end-users.

FLOOD RISK EVALUATION

After some delays in establishing underlying input datasets, the Terms of Reference (ToR) for a flood risk evaluation of Dar es Salaam was developed, circulated for comment, and revised, and a call for Expressions of Interest was conducted. More than 50 firms responded, and the procurement process is expected to be completed by mid-2019.



| Flooding on Morogoro Road. Photo credit: Chris Morgan.

The project will include a full hydrological analysis and flood hazard and risk modelling exercise of the cities of Dar es Salaam and Zanzibar, with an additional, more sophisticated probabilistic analysis carried out for Dar es Salaam. A key part of the project will be the development and implementation of a comprehensive flood risk data and information dashboard system that will ensure the study outcomes are used and provide actionable and relevant data and information for flood risk specialists, management, and decision makers at all levels.

“Adopting a probabilistic approach to flood risk management is not new, but it is a rapidly evolving technique, driven largely by the view of an accurate understanding of risk, in terms of economic and financial exposure and contingent liability, as essential.”

– Scott Ferguson, Technical Director – Flood Risk Management, Ambiental

CHALLENGES AND LESSONS LEARNED

FY19 has seen a shift in focus from rapid data acquisition to support planning and modelling activities at the start of TURP towards activities involving dataset updates, quality review and sustainability, and management. Consequently, some critical datasets have been revisited and resurveyed and much time has been invested in working with universities to transfer skills and know-how for conducting updates. A significant emphasis has been placed in 2019 on working with local teams – either GoT teams, universities, or local firms – to establish local capacity and sustainability of updates and digital services.

A few notable challenges were:

- **Data accreditation and licensing** – 2018 saw several amendments to the National Statistics Act, which placed some uncertainty on the formality of citizen-sourced datasets, such as Ramani Huria, and university-created datasets. Several workshops were added to engage with National Bureau of Statistics and PO-RALG data teams to socialize concept

of data licensing and discuss a hierarchy of official and unofficial datasets. This “spectrum” of data sources is still an ongoing review and each dataset makes a case-by-case decision on the authoritative source. However, adjustments to the Statistics Act in late 2019 provide for greater confidence that both official and unofficial sources can be used when technically appropriate.

- **Hydromet validation** – Delays were experienced in 2019 in implementing a practical meteorological data validation protocol for the TAHMO stations. This process has not been undertaken before in Tanzania and has been subject to changes in location for station co-location as well as availability of TMA staff.
- **Aerial surveys of rivers** – UAV mappers continued to encounter delays and uncertainty in processing flight permits, making it difficult to time flight for peak flood occurrence or peak dry season survey.
- **Uncertainty of future government activities** – several of Pillar 1 data acquisition and basin monitoring activities were designed around the expectation of Recipient-(Government) Executed Grant to mitigate flood risk in Dar es Salaam. Currently, no such agreement has been signed, and hence the operational requirements and resources for a basin monitoring network remain at a conceptual level. Some instruments, such as TAHMO, were intended as demonstration networks, with decisions on how and when to operationalize, dependent on the kick-off of a government program.
- **Secondary cities demand** – there remains significant demand from secondary cities for risk-assessment activities and data surveys. Sequencing and coordination of engagement has been challenging, given multiple objectives and shifting priorities.

Pillar 1 Challenges



DATA ACCREDITATION
AND LICENSING



HYDROMET VALIDATION



AERIAL SURVEYS OF RIVERS



UNCERTAINTY OF FUTURE
GOVERNMENT ACTIVITIES



SECONDARY CITIES DEMAND

FINANCIALS

Pillar 1 projects have disbursed USD \$1,148,000 in FY19, with a total of USD \$3,384,000 since the program started. Financial summaries are detailed in Section 8

➤ Pillar 2

Risk Reduction



OBJECTIVE

To strengthen the identification and understanding of climate risk and uncertainty in the local context.

OVERVIEW OF PROGRESS

Pillar 2 remained quite active in FY19 with several ongoing, scaled-up, and new commitments. Community Risk Mitigation activities received the majority of grant funds, including support to

the World Cleanup Day campaign in a move to highlight the issue of solid waste.

Msimbazi River Revitalization was another priority as steps were taken to release the Msimbazi Opportunity Plan early in the year. This strategic guide for intervention in Dar es Salaam's most flood-prone zone was shared with decision makers, and it is hoped that in 2020, consensus will be achieved for implementation.



ACTIVITY	STATUS	PROGRESS
Socioeconomic Studies	COMPLETED	Studies concluded with background papers and policy recommendations
Msimbazi Flood Infrastructure Diagnostic	COMPLETED	Monthly workshops conducted, engaging critical stakeholders, conceptualizing 10 strategies conceptualized, and finding consensus found for a design vision
Msimbazi Design Charrette and Special Planning Area	COMPLETED	Finalized and included in the Msimbazi Opportunity Plan
Msimbazi River Basin Management Framework	COMPLETED	This task evolved into a solid waste research and analytics tool, working with local government and Nipe Fagio to quantify waste mapped by Ramani Huria
Msimbazi Displacement and Resettlement Strategy	COMPLETED	Successfully delivered, – including community awareness activities, training of trainers, solid waste mapping, a large-scale clean-up, and a brand audit
Community Level Risk Reduction	ONGOING	Formative studies finalized, community risk maps developed, and contract signed



| The April 2018 flooding in Dar es Salaam had a devastating impact on lives, assets, and infrastructure

SOCIOECONOMIC STUDIES

In FY19, two socioeconomic studies were conducted to explore and quantify the relationship between poverty and flood risk in Dar es Salaam and better understand specific village community resilience actions and networks.

POVERTY AND DISASTER RESEARCH

The first of these focused on the role of poverty in exposure (those affected by floods), vulnerability (what is lost in floods), and socioeconomic resilience (how do the affected cope and recover). The goals were to understand how policy can strengthen resilience and to capture synergies between risk management and poverty-reduction actions.

Researchers used household surveys and combined information on how households experience flooding in the city with socioeconomic characteristics and information on levels of annual expenditures obtained using the Survey of Well-being via Instant and Frequent Tracking (SWIFT) methodology. Additional data was collected through focus group discussions with community members and through a follow-up interview over the phone six months after the April 2018 flood.

Results show that vulnerability to flooding is a widespread problem throughout Dar es Salaam. Overall, 39% of the population (equating 2 million people) was reported as having been impacted either directly or indirectly. Poorer households are more likely to be affected by floods directly and even more so indirectly. Directly affected households are more likely female-headed and have more insecure tenure arrangements. Indirectly affected households, in turn, tend to have access to poorer quality infrastructure.

While rent values seem unaffected by flood risk, household estimates of dwelling values were found to be consistently lower among affected households. It was also found that affected households suffered significant losses of about 23% of annual income on average, but these losses were unequally distributed.

Focusing particularly on the floods of April 2018, few households suffered very large losses, and the large majority lost up to 10% of annual income. Surprisingly, poorer households are not over-represented among the households that lost the most – even in relation to their income. This could be because 77% of total losses were due to asset losses, with richer households having more valuable assets.

While indirect losses due to health and missed days of work are relatively small, they have significant well-being effects for affected households. In total, it is estimated that losses experienced by households due to the April 2018 flood reached

over USD \$100 million, representing close to 2% of the GDP of Dar es Salaam.

Furthermore, poorer households were less likely to recover from flood exposure.

Through this research, it was clear that access to finance plays an important role in recovery for households.

“Losses experienced by households due to the April 2018 flood reached over USD \$100 million, representing close to 2% of Dar es Salaam’s GDP”

– Socioeconomic Study on Poverty and Disaster



Impact on Households



Over USD \$100m

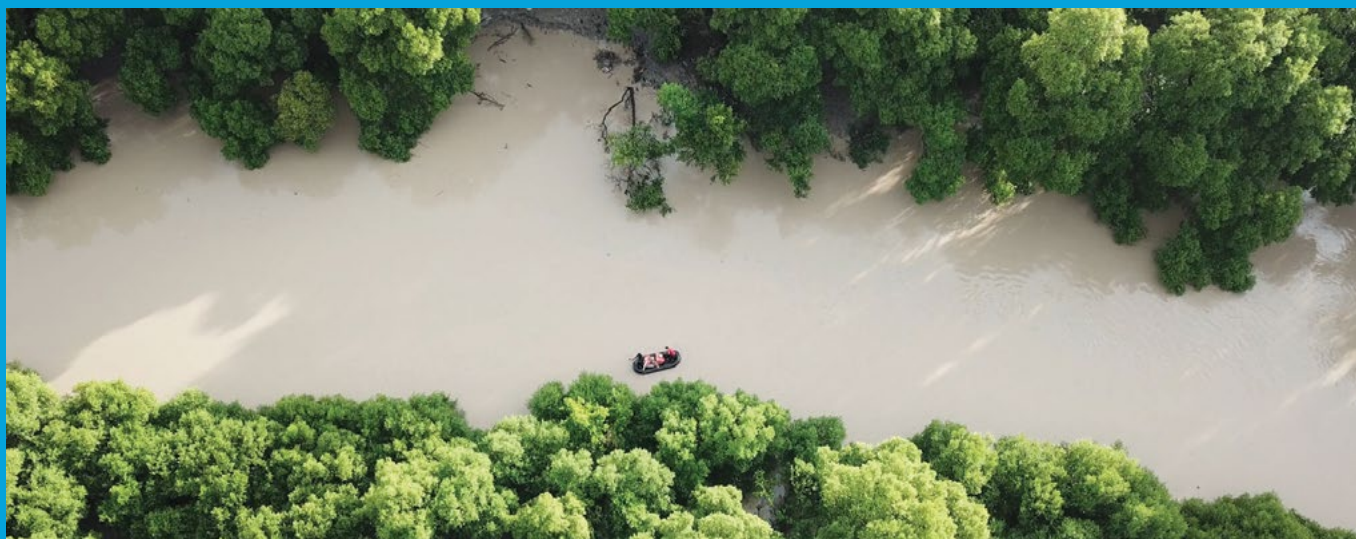
ESTIMATED LOSSES EXPERIENCED BY HOUSEHOLDS IN THE APRIL 2018 FLOOD



Spotlight Story

Draining Dar's Economy – The Impact of Floods on Tanzania's Commercial Capital





Dar es Salaam's economy and infrastructure suffers from frequent and severe flooding, and the situation will get worse in the absence of major interventions. In May of 2019, uninterrupted rainfall caused serious flooding in Dar es Salaam; 1,215 households were displaced, roads and bridges destroyed, and 1,560 dwellings were swept away. This disaster extends the growing list of flood events having struck the city in recent years.

Dar es Salaam was affected by similar incidents in 2009, 2010, 2011, 2014, 2015, and seven floods alone impacted the city between 2017 and 2018. These events are a constant reminder of the urgency to address urban flood risk which causes major disruption to mobility, basic daily routines such as getting to work or school, and worse the diseases that dirty flood waters bring to affected communities. The health impacts can reverberate for months after flood waters subside, and without taking action now, flood risk and health hazards will further increase in the coming decades because of urban intensification.

But the impact of floods in Dar es Salaam should also be understood as a barrier to poverty reduction and a constraint on national economic growth. Recently published World Bank research provides insights to the scale of the problem in the city; exposure to floods is wide-spread with at least 39 percent of the population, or 2 million people, having been impacted either directly or

indirectly by floods. The April 2018 flood alone affected between 900,000 and 1.7 million people.

Beyond these stark numbers, this research also shines a light on the role of poverty in terms of exposure, vulnerability, and socioeconomic resilience. We are now able to begin understanding who is affected by floods, how much people lose in floods, and to what extent those affected can cope with and recover from floods.

A closer look at income distribution reveals that the poor and vulnerable are over-represented among those affected by floods in Dar es Salaam; people experiencing direct flood damages have per capita expenditures that are 14 percent lower than non-affected people and are also significantly more food insecure than the average. Another concerning insight is that female headed households, which are less equipped with the tools to cope with disasters, are more likely to be affected.

APRIL 2018 FLOOD

LOSSES

Direct losses (house repair and asset loss)	USD \$101,480,000* - USD \$215,860,000
Indirect losses (health & labor)	USD \$5,547,0-0 - USD \$11,825,000
Total losses	USD \$107,027,0-0 - USD \$227,685,000
% of city GDP	1 – 4 percent

By extrapolating the results to a city level, the April 2018 flood cost the population an equivalent of 2 and 4 percent of the city's GDP, or between US\$107-227 million in losses. On average, affected households lost 23 percent of their annual expenditure. This equates to 84 days of a typical household's expenditure. However, results of the vulnerability assessment are somewhat surprising. Poorer people were not the ones who lost the most in relation to their income. One explanation is that poor households have fewer assets to lose and are less likely to undertake housing repairs, resulting in a lower monetary value of losses.

This does not mean that the poor are less vulnerable to floods. When asked about their experience of the floods, affected households consistently responded that their biggest concern was their health and that of their children. Having water in the house increases the risk of cholera and skin infection. When the flooding gets out of control, parents struggle to keep their children out of the water. Therefore, in addition to the healthcare costs, flood exposure is associated with enormous stress and discomfort, impacts which are challenging to capture in impact assessments of disasters.

Moreover, disasters are not isolated events. Recurring floods in Dar es Salaam place some people in a constant state of recovery, with

a cumulative negative effect on poverty and prospects for the future. The data confirms that poverty is associated with lower capacity to recover. Understandably access to finance can help people to recover from such shocks, but formal finance is seldom available. This is particularly the case for female headed households who are 11.5 percent less likely to practice saving, and 9 percent less likely to have a bank account when compared with male headed households.

Investments for urban flood control in Dar es Salaam can help reduce poverty if targeted and designed thoughtfully. A balanced integration of traditional infrastructure focused measures, such as dredging and channeling works, drainage systems, combined with innovative nature-based solutions can be accompanied by non-structural measures such as risk-informed land use planning, building guidelines, forecasting and early warning systems. But to also strengthen vulnerable populations, investments need to be integrated with considerations of financial inclusion and social protection. Boosting Dar es Salaam's resilience to floods will not only help affected households escape poverty, it will also boost the city's important economic contribution to a more prosperous Tanzania.

COMMUNITY RESILIENCE STUDY - MUTUAL AID/SAVINGS GROUPS

The second socioeconomic study explored the relationship between membership of mutual aid/savings groups and resilience to floods. This study drew upon a combination of quantitative and qualitative research methods. Specifically, household survey data was collected to measure patterns between Village Community Bank (VICOBA) group membership and preparation, response, and recovery from floods. In-depth interviews and focus groups were also undertaken to understand the pathways that underpin these patterns.

The final report from this study shows a significant positive relationship between group membership and resilience. According to the data, researchers found that nearly one-quarter of households have at least one member in a group, and that households with member(s) are 16% to 25% more likely to have been able to save in the last month, and 12% to 17% more likely to say they have access to informal financing (all other things being equal). They are also 10% to 12% more likely to have recovered from past flood events.



With this knowledge, the study highlights five different pathways through which groups can bolster household and community resilience to floods: (a) saving and lending activity, (b) informal insurance, (c) non-financial mutual aid, (d) collective enterprises, and (e) community service. Members use these pathways to prepare, respond, and rebuild after floods. Specifically, evidence was found of members sharing information on weather, helping each other evacuate at-risk assets, and clearing drains before the rains come. When disaster strikes, membership also provides important alternatives to selling assets to smooth consumption: members can draw on savings, loans, and insurance payouts instead. Non-members may also benefit, as many groups see helping people beyond the group as central to their purpose. Examples include organizing emergency food relief and helping replenish damaged school supplies. Finally, in some cases, groups help members build back better — generating funds to improve housing or simply moving to a safer location.

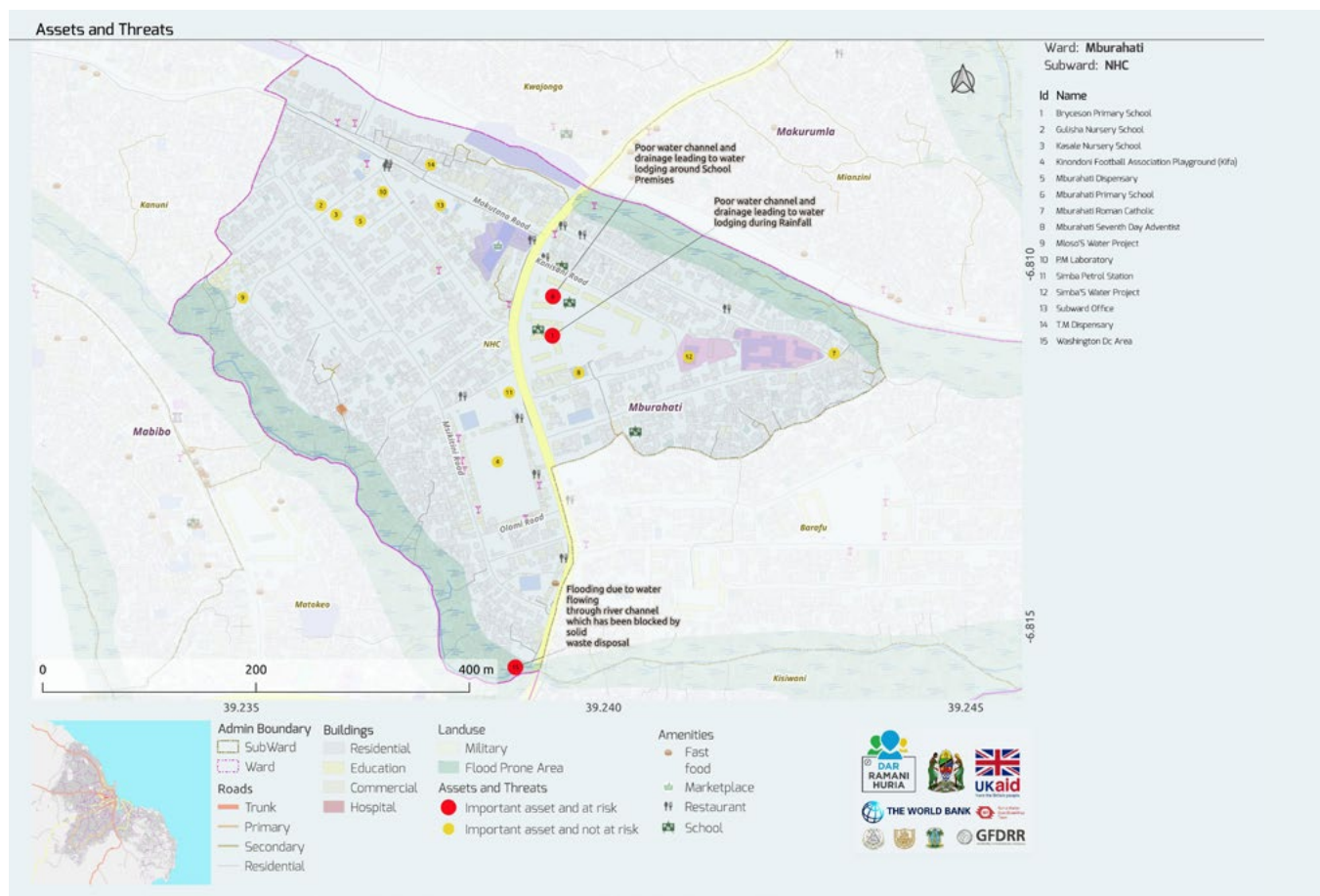
These insights have policy implications for Dar es Salaam and across the region, showing that savings groups are powerful networks for mutual aid and collective action, and that group members, leaders, and trainers can be agents for change in the community at large.

This study therefore concluded with three key policy recommendations:

1. Promote knowledge of disaster risk-management among savings group trainers and leaders.
2. Use savings groups to better gather and spread information at the community level.
3. Explore the possibility of matching funds to encourage preventative action“

“My neighbor saved my son’s life. She pulled him out of the floodwater. Because she was part of my savings group, she was able to get emergency cash from our group to pay for a Bajaji to take him to hospital.”

- VICOBA group member



Example of a Sub Ward Community Critical Infrastructure and Risk Map, Mburahati Ward, NHC subward

COMMUNITY ASSET AND THREAT INVENTORY

Recognizing the important roles that communities can play in reducing risk, TURP is dedicated to the delivery of community-led risk reduction activities. Base maps developed in Pillar 1 by Ramani Huria have been extended in 49 wards to include the mapping of community-identified assets and threats. The resulting inventory covers 243 sub-wards across Dar es Salaam.

Each community meeting conducted to create the inventory had 10 to 12 participants — two religious leaders; one leader of a community-based organization (CBO) and NGO available at the sub-ward; three representatives from sub-ward, health, and environment committees; one prominent elderly person with good knowledge of the neighborhood; one prominent young person with good knowledge of the neighborhood; and one to

six Shina leaders. Six student mappers facilitated the process. The guided discussion was based on three major key points:

1. Assets (important things in the sub-ward)
2. Assets under threat if the sub-ward floods
3. Main causes of flood in the sub-ward

More detailed descriptions on the methodology and human resources that were used in the Assets and Threats project can be found in the Community Asset and Threat Handbook³.

Data collected via the community assets and threats identification process is accessible on the Resilience Academy geonode online at: https://geonode.resilienceacademy.ac.tz/layers/geonode:rh_assets_threats_mapping_2018

³ Available online: <https://docs.google.com/document/d/11HQttl5Pb8IF-gATufV4LxaDn0eCXEcEuA56phrf1X0Y/edit>

COMMUNITY RISK REDUCTION PLANS

The creation of the community asset maps was used as a foundation for the subsequent development by TURP consultants, in collaboration with Disaster Management Committees, of a toolkit for creating and implementing standardized Community Disaster Risk-Reduction Plans (CDRRP).

Comprehensive templates were established for ward-level DRRPs and Master Trainers were trained from both the TRCS and the Municipality Disaster Management Committees who will lead the training of Ward Disaster-Management Committees.

The toolkits, templates, and training were initially piloted in three wards: Kigogo, Tandale, and Kawe. A total of 13 sub-wards were reached through these three wards, which included reference to the sub-ward asset and risks maps. It is expected for this project to scale up in FY20 to engage an additional seven Ward Disaster-Management Committees, including 35 additional sub-wards.

WORLD CLEANUP DAY

Poor solid waste management is a growing issue across Tanzania and has been identified in TURP-funded research as a top contributor to disaster risk – clogging drains, polluting waterways, and causing disease outbreaks. Improved solid waste services, combined with community engagement are foundational to addressing the current situation. In recognition of this, the TURP team supported Nipe Fagio – a local NGO concerned with solid waste – in FY19 on the World Cleanup Day, Let's Do It World Campaign.

This campaign involved a series of community awareness-raising activities, training-of-trainer events related to solid waste management, as well as a large-scale community-led clean-up across Tanzania, where 102 clean-ups were organized in 30 towns in 13 regions, ultimately engaging over 26,000 people, who helped to collect 18,547 bags – or 466,378 kg – of trash across the country.



Developing effective Community Disaster Risk-Reduction Plans is a collaborative process



World Clean Up Day in Dar es Salaam



Over 8,000

VOLUNTEERS AND OVER 26,000
CITIZENS WERE ENGAGED



145,280 kg

OR NEARLY 8,000 BAGS OF
TRASH WERE COLLECTED



31

SITES CLEANED IN
DAR ES SALAAM

TURP also took on a leading role in the implementation of solid waste hotspot mapping activities associated with this event. The resulting data was not only critical for successful delivery of the project, but it continues to inform waste management initiatives in Dar es Salaam.

While overseeing this project, TURP worked with Nipe Fagio to conduct brand audits for 31 sites cleaned in Dar es Salaam. This effort engaged over 8,000 volunteers and resulted in nearly 8,000 bags — or 145,280 kg — of trash collected. It was recorded that much of the waste collected had been produced by Tanzania-based manufacturers and a few recognizable global brands. Nipe Fagio has used this audit to effectively lobby the government and private sector to “Break Free from Plastic”.

During FY19, the development of a Twaa Mtaro (Adopt a Drain) operational maintenance system was paused and efforts were redirected. In part, the early warning and early action functions have been merged into an EMIS (discussed in Pillar 3) and

the drainage and waste visualization tools geared towards supporting waste mapping and analytics. Twaa Mtaro was used as an interactive web and mobile tool for the trash-mapping activities supporting Ramani Huria and Nipe Fagio.

This project engaged more than 100 student mappers in locating and collecting information about the types of waste piles in the Dar es Salaam. The resulting data has enabled analysis, visualization, and development of an artificial intelligence (AI)-based tool to quantify waste hotspots. Using machine learning, 9,172 waste pile images were processed via an analysis tool (<http://trash-detection.herokuapp.com/>) to detect if they contained trash. Of those images, 1,555, or 17%, were found to contain no trash, while 7,617 images (83%) contained trash. A visualization of the image analysis can now be accessed via the trash map (<http://dar-trash-viz.herokuapp.com/>) under the Analysis menu. Sample image analysis produced by the trash detection tool is also available at <http://trash-detection.herokuapp.com/>.



MSIMBAZI RIVER REVITALIZATION: BASIN MANAGEMENT FRAMEWORK AND SPECIAL PLANNING AREA

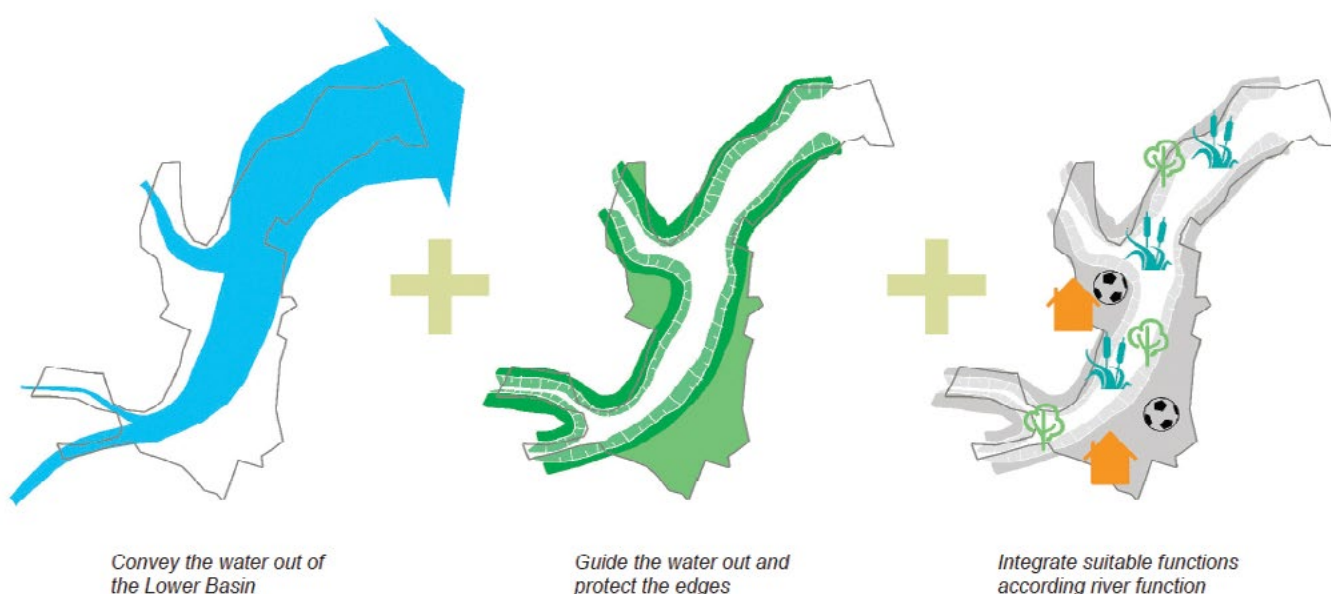
As reported in FY18, the TURP team conducted a participatory design charrette to provide the analytical basis for informed decision-making on the mitigation of flooding in and around the Msimbazi River Basin. Outputs from the process were produced in the form of (a) a Strategic Development & Management Framework; (b) a Detailed Plan for the Lower Msimbazi; (c) a new boundary for Msimbazi Special Planning Area; and (d) a flood model calibrated specifically for assessing the benefit of interventions in their lower basin.

Over FY19, these outputs galvanized support from all levels for an integrated course of action that will result in significant benefits for the city. Civil engineering works, such as dredging, will increase the water conveyance capacity of the river. Ecological interventions, such as upstream reforestation, will reduce erosion and sedimentation. Improved land use planning and enforcement will keep people and assets out of

harm's way, and some hazardous areas can be reclaimed and made safe for urban development. These interventions have been outlined in detail within the Msimbazi Opportunity, a three-volume plan packaged and distributed widely across government and stakeholder institutions.

The first steps to set the plan into action were initiated in August 2018, when the Strategic Development and Management Framework and the Detailed Plan for the Lower Basin were publicly presented. During this time, Selemani Jafo, Minister of State, PO-RALG, and January Makamba, Minister of State, Vice President's Office, Environment and Union Affairs both pledged their support. PO-RALG is now actively engaging with Ministry of Finance to secure initial funding from the World Bank.

For the lower section, costs are estimated at USD \$55 million, and for the upper section, USD \$49 million. Other related costs, such as reforestation and sediment traps in upper areas, that are essential for sustainability of the Lower Basin investments over the long term, are estimated at USD \$10 million. The preliminary estimated total costs, therefore, are USD \$114 million.





| Existing Situation in the Lower Msimbazi

By combining comprehensive drainage improvements with commercial development, the detailed plan for the Lower Basin would establish a framework that coordinates investments from various sources, including government, private sector, and development partners to restore the highly vulnerable flood plain in the middle of the city, and turns this area into a valuable city asset.

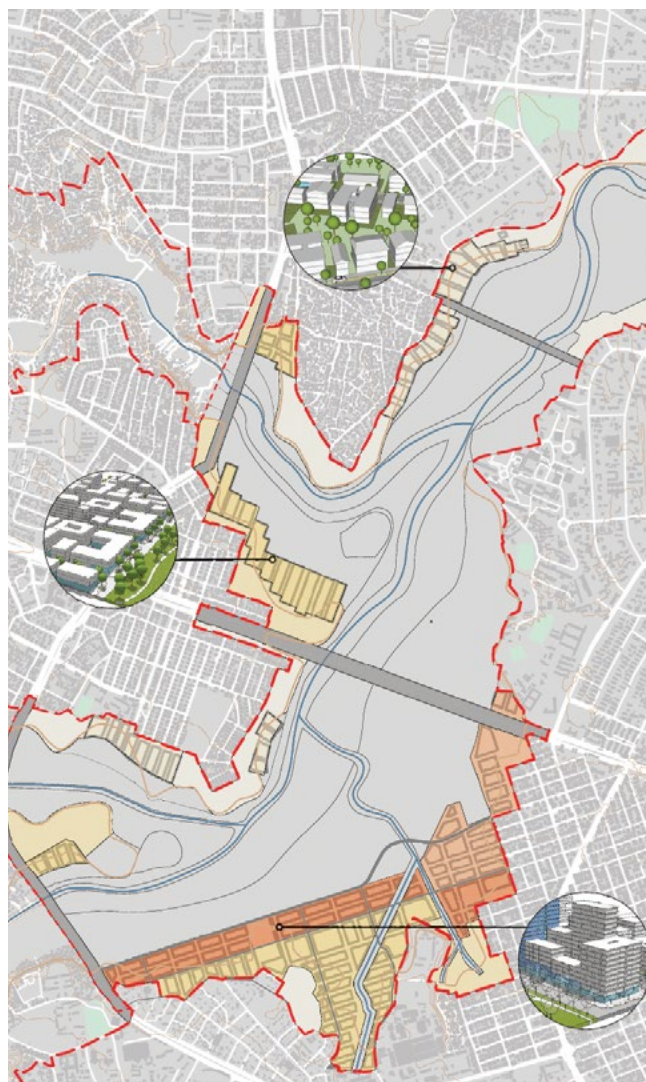
In FY19, the TURP-associated City Resilience Program (CRP) commissioned PricewaterhouseCoopers (PWC) for 18 weeks to study project-structuring for the new 57 hectares mixed-use urban development in the Lower Msimbazi Basin to streamline project preparation. The study aligns the proposed development vision with current considerations, views of relevant stakeholders, TURP goals, and market; includes a financial evaluation based on financial models, including testing key financial ratios and other relevant key performance indicators (KPIs) and sensitivities; and evaluates feasible delivery models, transaction structures, and institutional arrangements.

Noted within the Msimbazi Opportunity, even with the proposed interventions, most of the valley's lowest-lying lands will remain unsafe for human habitation. For these areas, it has been proposed that residents be resettled according to international best practices, and flood-prone



| Envisioned Situation in the Lower Msimbazi (with intervention)

land be transformed into a wetland park that will provide both recreational and ecological value for the city of Dar es Salaam.



| Potential for urban development around the Msimbazi

However, with time and a changing climate, the once-perennial riverbed has become seasonal. For much of the year, the river is almost completely dry. Then the rain comes and the river changes in character dramatically, causing flash floods to occur along the river and its many tributaries. These have often resulted in several fatalities each year, along with the destruction of critical infrastructure supporting the city.

To pragmatically address the recurrent flood risk in Dar es Salaam, a participatory design process known as a 'Charrette' was undertaken from January to August 2018 involving the dedicated efforts of more than 200 people from 59 institutions and communities across 30 working sessions. Led by the PO-RALG with support from the World Bank's UKAID-funded Tanzania Urban Resilience Program, this process has yielded The Msimbazi Opportunity Plan – a comprehensive blueprint for transforming the basin from a hazardous liability into a beacon of urban resilience.



| May 13, 2019 BRT Depot and Jangwani BRT Station (Morogoro Road). Photo credit: Chris Morgan.



Msimbazi River Revitalization

Interventions for the Lower Basin



300m

BRIDGE DESIGNED TO
ACCOMMODATE A 100-YEAR EVENT
FOR IMPROVED URBAN MOBILITY

3km

OF WIDENED AND DEEPENED
RIVER FOR IMPROVED HYDRAULIC
CAPACITY

57 hectares

OF NEW LAND FOR RETAIL,
COMMERCIAL, AND RESIDENTIAL
DEVELOPMENT FOR CITY CENTER
MODERNIZATION





Spotlight Story

Transforming the Msimbazi from a Liability to an Opportunity

LINK www.worldbank.org/en/news/feature/2019/08/12/transforming-tanzanias-msimbazi-river-from-a-liability-into-an-opportunity





The Msimbazi Valley is a vast greenspace in the center of Dar es Salaam – Tanzania’s commercial hub city that houses 27% of the city’s population. Historically, the river served as an important water source, and the fertile floodplain provided prime land for agriculture and animal grazing.

STRATEGIES FOR INTERVENTION

The Msimbazi Opportunity Plan envisages four strategies to redesign the Msimbazi: Mitigate, Protect, Transform, and Govern. The Mitigate strategy aims to reduce the flood hazard itself, while the Protect strategy aims to reduce the people, properties, and vital infrastructure that are exposed to the flood hazard. Under the Transform strategy, the goal is to convert the most flood-prone areas of the valley into a city park and redevelop surrounding neighborhoods. The Govern strategy will nurture a planned and coordinated process for urban development and ecosystem restoration in the Msimbazi Basin, and thus stop the current uncontrolled urbanization process that results in increased flooding.



| The Msimbazi Charrette. Photo credit: Chris Morgan.



The Msimbazi Opportunity



27%

OF THE CITY'S POPULATION IS
NOW IMPACTED BY FLOODING
IN THE MSIMBAZI



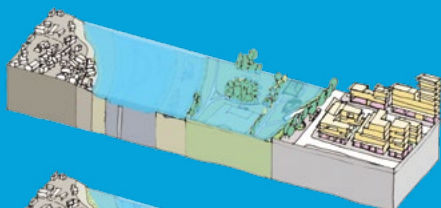
USD\$900m

POTENTIAL REVENUE IN
HOUSING DEVELOPMENTS

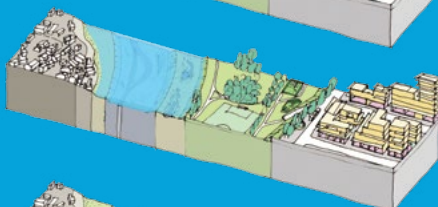


USD \$740m

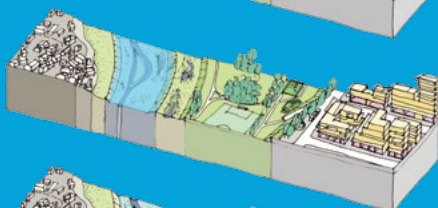
POTENTIAL REVENUE FOR
THE GOVERNMENT OF TANZANIA



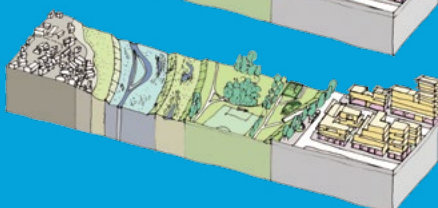
Proposed section in
t= 100 flood event



Proposed section in
t= 10 flood event



Proposed section in
wet situation



Proposed section in
dry situation

DESIGN PRINCIPLES FOR A RESILIENT RIVER BASIN

To better understand the flood hazard affecting the basin, flash floods were simulated through a flood model by considering bursts of rainfall over a relatively short period of time. Based on the results, which showed in detail how the Msimbazi Basin is impacted by flooding and how this will affect the area over time, three priority design principles were identified within the Msimbazi Opportunity Plan for initial implementation:

River: Focus on conveyance to drain river water from the basin to the ocean as quickly as possible

- In this plan, the Msimbazi River is given room in the Lower Basin to respond to severe peaks of water that it transports from the upper

catchment to the ocean. A series of three interventions have been conceptualized, involving dredging of the river channel and additional widening and raising of key bridges.

Terraces: Create elevated terraces to guide the water and create higher edges to protect against flooding

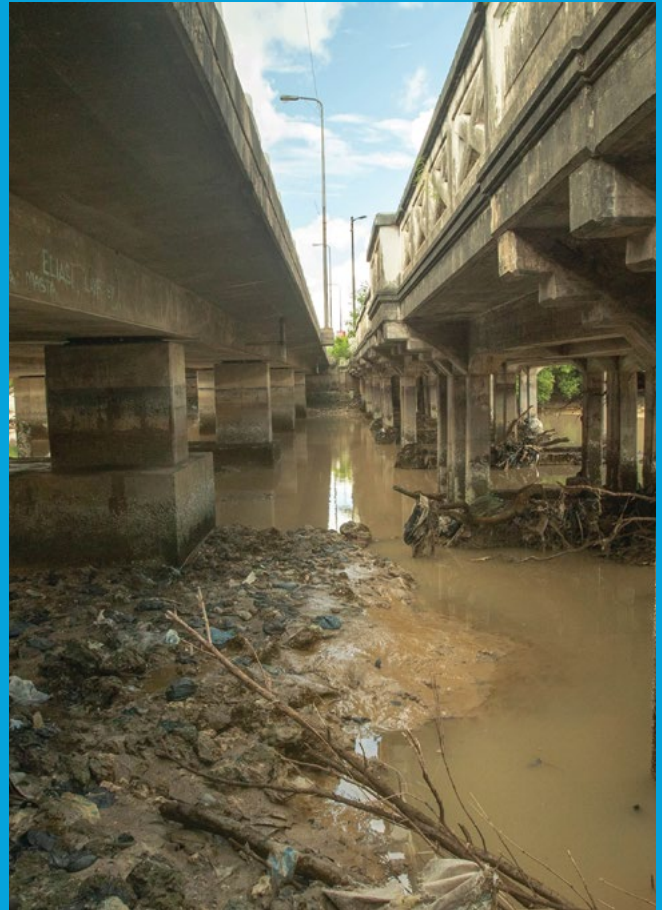
- The basic principle of the terraces is to use the material that becomes available from dredging for the formation of elevated terraces. The terraces will be constructed in phases and filled terrace sections will be protected against erosion immediately at the end of each construction phase. The intention is to create space for the river, while reclaiming parts of the floodplain for the development of the proposed city park.

Detailed Areas: Create a city park with functional uses of the terraces and the flood plains

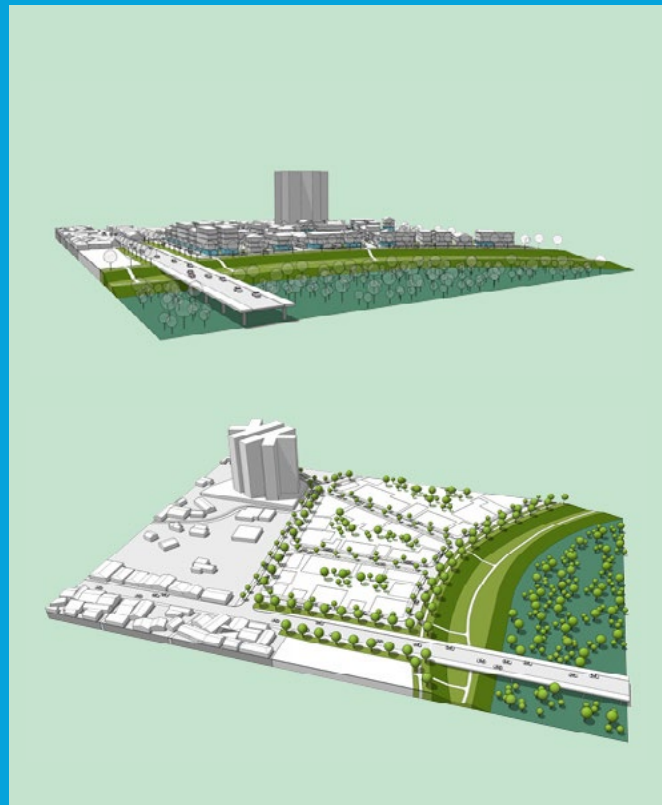
- The Msimbazi Opportunity Plan contains several location-specific elements to revitalize the area and unlock its environmental, social, and economic potential.
- The city park is envisioned as an accessible, wide green space that is well connected to the surrounding areas and urban fabric.
- Wetlands and Mangroves are envisioned as part of the park space that includes the river channel and flood plains, with a system of footpaths and footbridges that will facilitate public access
- Urban Development Areas are envisioned as a new urban front towards the valley and the new city park, enabled by terracing

MAXIMIZING FINANCE FOR DEVELOPMENT

Based on the Urban Development guidelines designed for the project, the urban regeneration potential across 57 hectares of land could provide over 14,500 real estate units across a range of typologies, sizes, and places.



| Msimbazi site visit. Photo credit: Chris Morgan.



| Prime Land Reclamation - 57 ha of new land for retail, commercial, and residential development for city center modernization

By combining comprehensive drainage improvements with commercial development, the detailed plan for the Lower Basin would establish a framework that coordinates investments from various sources, including government, private sector, and development partners to restore the highly vulnerable flood plain and turn this area into a valuable city asset.

Preliminary analysis leads to a projected estimate of USD \$900 million in potential revenues in housing development, which is only one portion of expected economic benefits. Based on projected cash flows from different economic activities within the valley, cost recovery on capital expenditure would be reached over a period of 12 years and at an expected internal rate of return of 18%.

MOVING FORWARD

With this comprehensive plan in place, the GoT is now taking steps to move from planning to action. Through additional support from the World Bank's City Resilience Program, the project is now advancing to undertake a commercial and market review, financial analysis, and regulatory and transaction structuring assessment, which will collectively further guide the project's implementation.



During FY19, the focus for Pillar 2 has been on quantifying and advocating the benefits of identified risk reduction and planning activities. The outputs of the Msimbazi Charrette in particular have been designed, packaged, and presented to various decision-makers. Feedback from GoT stakeholders has led to additional analysis on economic returns, private sector partnership opportunities, and alignment with associated infrastructure investment such as a proposed wastewater treatment plant.

Similarly, activities advocated for by community risk-planning initiatives and through civil society efforts have raised awareness and demand for projects addressing solid waste, drainage, mobility, and recovery. Through the implementation of such activities, some identified challenges include:

- **Customizing for a Range of Audiences** – The conclusion of the Msimbazi Design Charrette has not been the conclusion of the project design, but rather its inception. Work has been necessary to present the project interventions to various decision makers and ensure alignment with several ongoing government priorities. This has led to additional studies and consultations in order to provide sufficient justification on economic grounds as well as coordination with ongoing projects.
- **Disaster Management Committee Sustainability** – The roll-out of the community risk reduction planning process has been conducted via a pilot due to uncertainties regarding the sustainability of ward- and sub-ward-level village disaster management committees. Such entities are called for in the 2015 Disaster Management Act of Tanzania, but in practice are nascent. As such, without formal procedures and structures in place, there has been uncertainty on how to budget transactions, training, and meetings.



Pillar 2 Challenges



CUSTOMIZING FOR
A RANGE OF AUDIENCES



DISASTER MANAGEMENT
COMMITTEE SUSTAINABILITY

FINANCIALS

In FY19, Pillar 2 projects were allotted funding from three grants: Risk Mitigation Planning, Msimbazi River Revitalization, and SWIFT Surveys on poverty and floods. Funds disbursed by these grants amounted to USD \$1,046,000.

Financial summaries are detailed in Section 8.

📉 Pillar 3

Emergency Management + Response



OBJECTIVE

To strengthen the capacity of stakeholders involved in short-term disaster events and preparedness to cope with specific emergency scenarios.

OVERVIEW OF PROGRESS

The priorities of Pillar 3 shifted from procurement of equipment to capacity building and systems development in FY19.

Aligning with this shift, a series of Training, Exercises, and Drills (TED) were conducted, an EMIS was introduced, and Community Disaster Response (CDR) plans were piloted across Dar es Salaam. Most of these activities have been supported by, or have served as support for, DarMAERT, with the goal of maximizing impact through integrated and coordinated response.



ACTIVITY	STATUS	PROGRESS
Damage Assessment Support	COMPLETE	Ramani Huria- affected household surveys during April 2019 flood and workshop planned for a national Lessons Learned Exchange and Post Disaster Needs Assessment; - set of July 2019.
Training, Exercises, and Drills (TED)	ONGOING	First of four training modules delivered to DarMAERT
Emergency Operations Center Support Structure	ONGOING	Proposal is now being prepared for the structure and management of the center
Emergency Management Information System EMIS	ONGOING	Development, testing, and validation concluded
Community Response Plans	ONGOING	Templates, toolkits, and training piloted in three wards (covering 13 sub-wards)
Early Warning System EWS Pilot	ONGOING	In partnership between the TAHMO Bus Rapid Transit BRT Flood Forecast demonstration and Community Water Watch project with focus on TRCS use case.

TRAINING, EXERCISES, AND DRILLS

One of the main challenges faced by DarMAERT has been limited access to resources for the training of emergency responders. TURP has addressed this by designing a comprehensive two-year TED program that follows international standard practices and procedures of emergency management agencies.

TED is comprised of a series of skills and training courses, as well as exercises and drills, that effectively build competency in the field of emergency response. It was designed with the active participation of DarMAERT core members and is being facilitated by an international consulting firm from the Philippines (EMI) in partnership with Ardhi University from Tanzania.

The first training module, 'Understanding an Integrated Emergency Management System', was delivered in April 2019, during which 36



Installing radio stations. Photo credit: Chris Morgan



The TED program will equip emergency responders with current, standardized skills for improved coordination

responders from DarMAERT were introduced to critical concepts behind emergency management systems. By the end of FY20, it is expected that DarMAERT will have completed all four readiness levels for emergency response: (1) Understanding, (2) Planning, (3) Practicing, and (4) Executing an Integrated Emergency Management System.

EMERGENCY OPERATIONS CENTER SUPPORT STRUCTURE

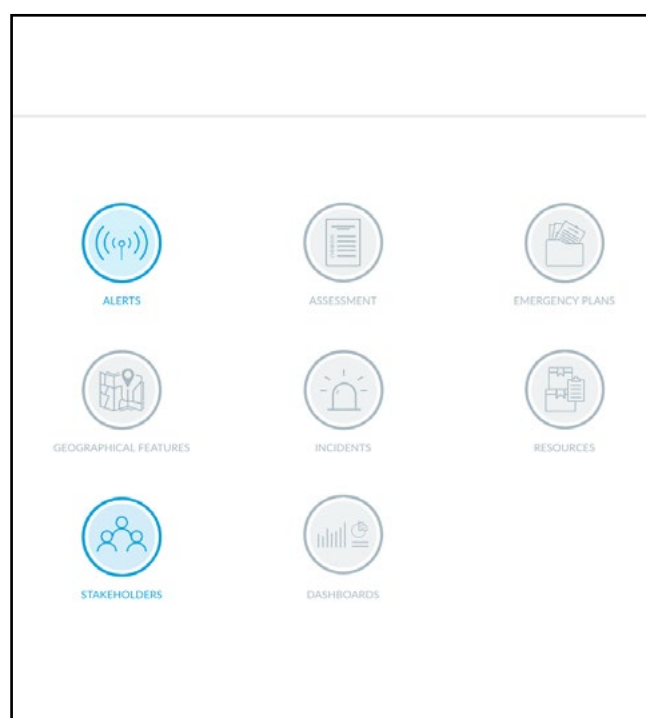
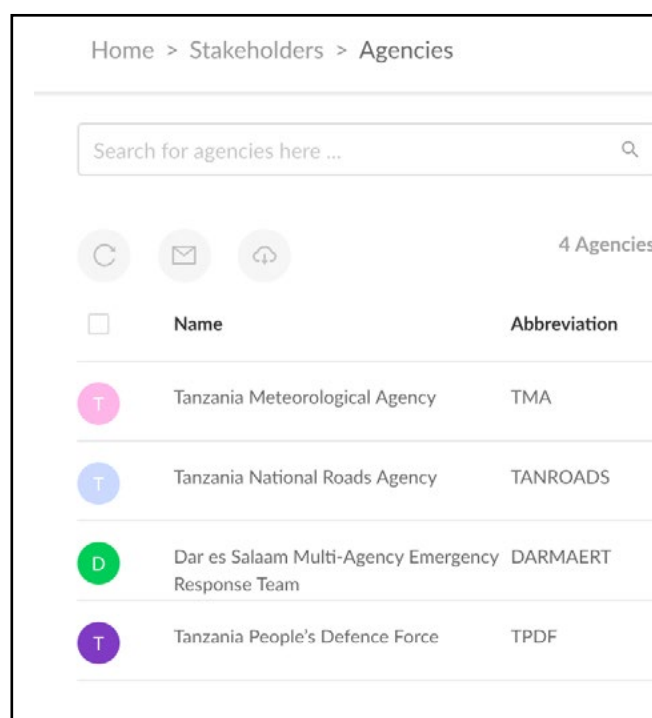
Another gap in Dar es Salaam's emergency management, as highlighted by DarMAERT, has been a lack of centralized coordination. As part of the work that is being conducted under the TED program, a proposal is being prepared to fill this gap by establishing an Emergency Operations and Communication Center (EOCC) in Dar es Salaam.

The proposal includes the appropriate structuring of a center that combines the needs of all DarMAERT agencies, as well as the development of protocols for its operation and management. Due to delays, the implementation of this activity has been postponed to FY20, but critical steps have been taken to prepare.

EMERGENCY MANAGEMENT INFORMATION SYSTEM

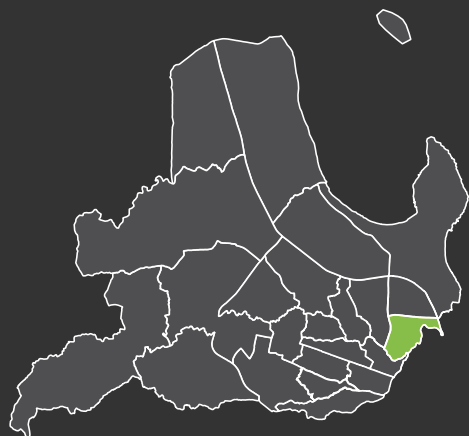
The EMIS is expected to function at the core of the EOCC. Once installed, EMIS will serve as a collaborative platform that can facilitate communication, planning, and actions before (to mitigate and be prepared), during (to improve response), and after (to aid recovery) a disaster. It consists of components that collectively provide data and tools to process and analyze early warnings for early action.

In early FY19, development, testing, and validation of the EMIS platform was conducted by TURP team. This was followed by the delivery of technical training to DarMAERT and agencies of the EOCC through which feedback was communicated to improve upon the platform's contextual functionality. It is expected that, through close collaboration with the DarMAERT coordinator, EMIS will be fully operationalized during FY20.





3 wards principally affected in the lower Msimbazi basin



Hananasif

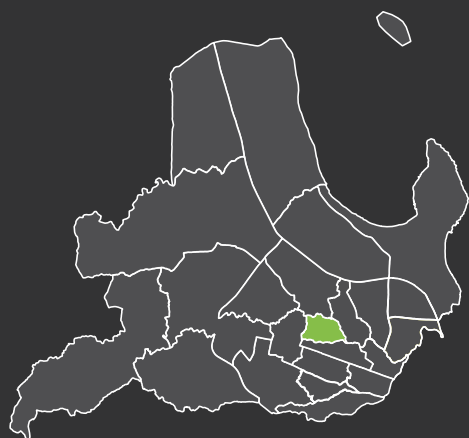
SUBWARD Mkunguni B
SURFACE AREA 1.85km²
FLOOD PRONE AREA 0.57km²



150 HOUSES
FLOODED



30% OF THE AREA IS
FLOOD PRONE



Tandale

SUBWARD Mkunduge + Sokoni
SURFACE AREA 1.17km²
FLOOD PRONE AREA 0.35km²

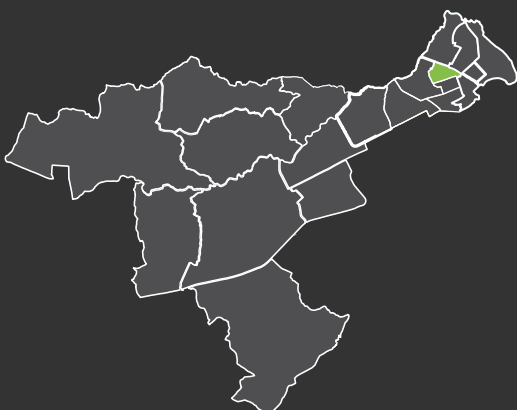


1100 HOUSES FLOODED
(MKUNDUGE)

230 HOUSES FLOODED
(SOKONI)



31% OF THE AREA IS
FLOOD PRONE



Jangwani

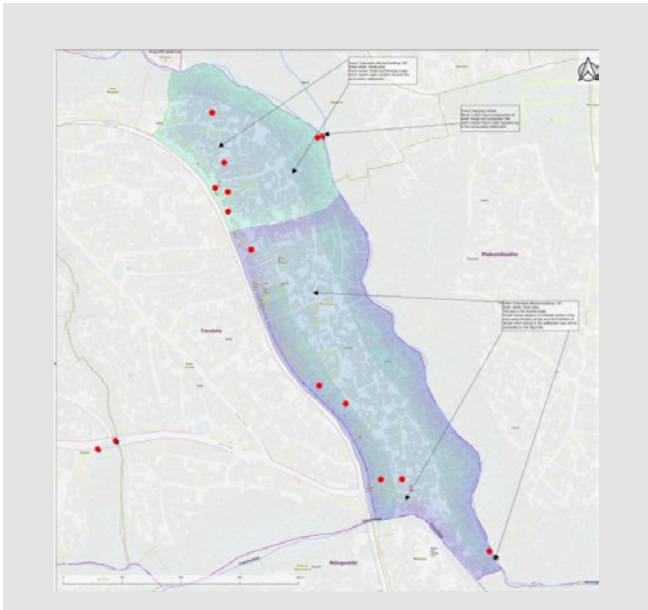
SUBWARD Mtambani
SURFACE AREA 0.6km²
FLOOD PRONE AREA 0.14km²



800 HOUSES
FLOODED



23% OF THE AREA IS
FLOOD PRONE



Flood Impact Assessment Map Developed by Community Respondents in Kwa Mkunduge Subward of Tandale following the March 3, 2019 flooding

DAMAGE ASSESSMENT SUPPORT

During the 2019 rainy season, Dar es Salaam experienced significant flooding in March, April, and May events. Several tools and methods were deployed to support DarMAERT in understanding expected damages as well as to validate new approaches that can be scaled up in the future.

As a response to heavy rainfall on March 3, 2019, which resulted in heavy flooding in some wards of Dar es Salaam, the Ramani Huria team was mobilized to conduct field mapping. This activity engaged affected communities with the aim of conducting a rapid assessment and producing impact maps. Three wards were principally affected in the lower Msimbazi basin.

COMMUNITY RESPONSE PLANS

Responding to community demand for localized disaster response, TURP has developed and finalized a toolkit support the Ward Disaster Management Committees in creating Community Disaster Preparedness and Response Plans (CDPRP) specific to the needs of their communities.

Thus far, templates have been established and Master Trainers have been trained from both the TRCS and the Municipality Disaster Management Committees, who will lead the training of Ward Disaster Management Committees. The training, toolkits, and templates were piloted in three of the city's most flood-affected wards: Kigogo, Tandale, and Kawe. A total of 13 sub-wards were reached through these three wards.

In FY20, training on the CDPRP will reach an additional nine Ward Disaster Management Committees with a goal of strengthening community resilience through clear and effective protocols on how to respond in the event of a flood.

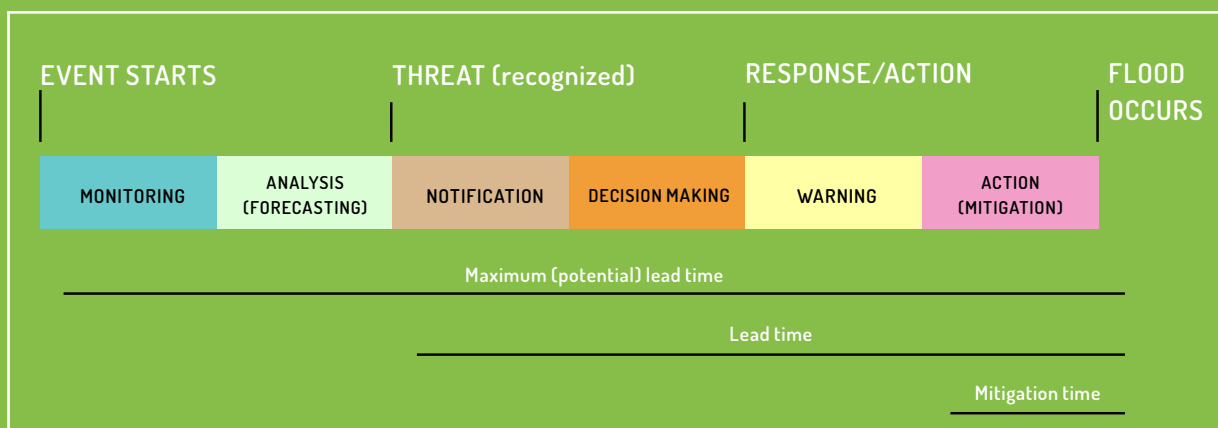
EARLY WARNING PILOT

In 2018, TURP agreed to collaborate on the development and piloting of EWSs with a consortium of existing TURP partners — Deltares, TU Delft, Flood Tags, and TRCS — which have formed a project known as Community Water Watch (CWW). CWW has mobilized additional resources and built on prior work financed by TURP in hydraulic modelling, capacity building, community engagement, and flood monitoring. CWW launched activities in October 2018 for a co-designed flood EWS that adopts and organizes existing open online media communication channels, relies on innovative affordable and robust weather stations, and uses hydrological models, built on open data and Ramani Huria data.

Building also on the TAHMO stations, CWW has developed an online media-based dashboard, demonstrating situational awareness and forecast models. The service has been developed with partners on the ground, led by TRCS and DMD, so that an effective community co-design can be realized. The dashboard aims to be piloted on data from the Msimbazi and surrounding wards, which are the most flood-prone areas of Dar es Salaam.



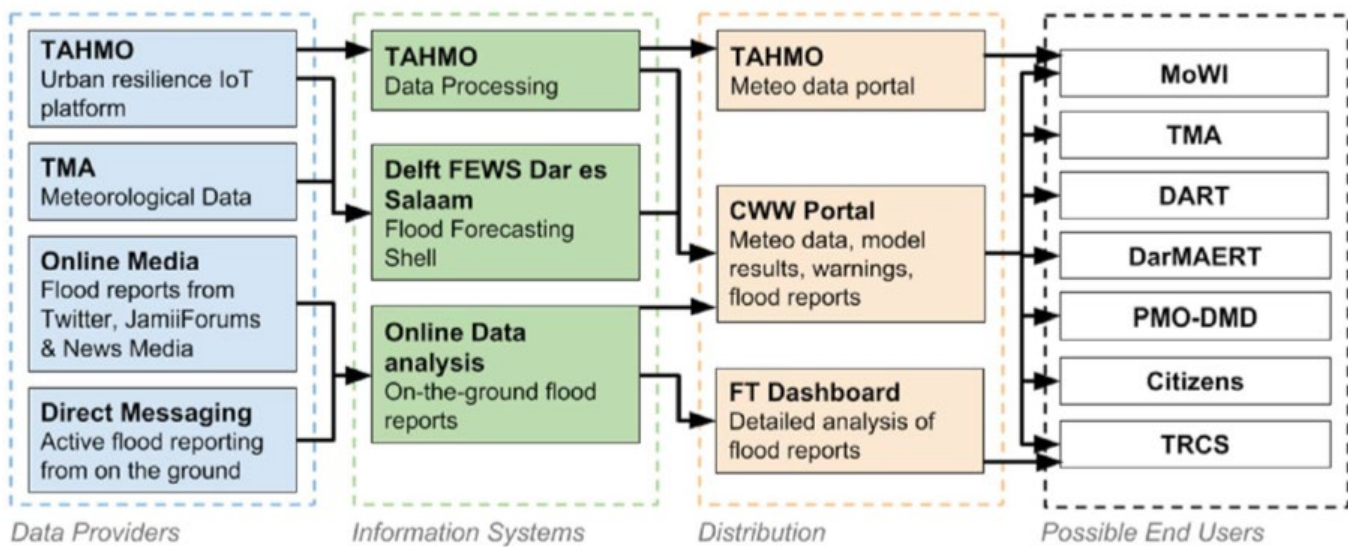
Monitoring and forecasting chain Source: Community Water Watch



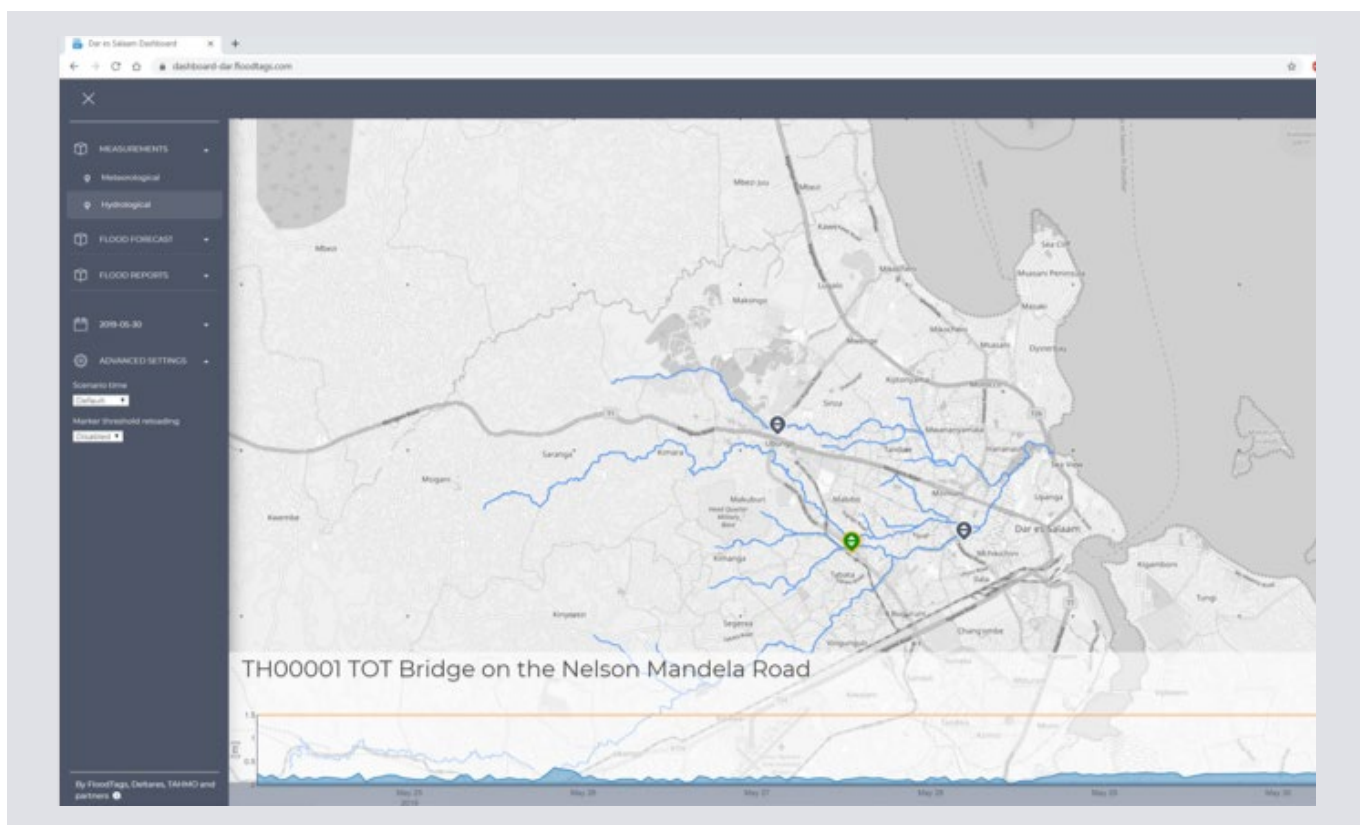
The 'monitoring and forecasting chain' following stakeholder workshop October 2018 Source: Community Water Watch

During late 2018, the consortium engaged in a "Rational Unified Process," a design process that leads to effective co-design, development and transfer. Interviews were held with key stakeholders to understand the problems they face, their needs, and their capabilities. This activity led to a better understanding of how the different organizations (users) see their responsibilities regarding flood early warning.

Four possible candidates for piloting CWW were identified and formulated as use cases. The four users include TRCS, DarMAERT, PMO-DMD, and the Dar es Salaam Rapid Transit Agency (DART). Two use cases involving TRCS and DART have since been selected for pilot development and work on them is currently ongoing.



Information Flow for Dar es Salaam Flood EWS Source: CWW



Prototype – Flood Monitoring and Forecast Dashboard

Besides the use case selection and forecast development, TURP has support Flood Tags to develop a flood monitoring and forecast dashboard. This visualization is a web-based tool that demonstrates how to combine and use a variety of input datasets from

existing meteorological data, supplemental measurements from TAHMO stations reading both meteo-sensors and river gauges, social media data, and direct use confirmations. The data flow is illustrated above and the current dashboard view is shown above.



How it Works

Flood EWS Dar es Salaam

To suit the needs of specific end-users — including their required forecast locations, required information (water levels, impacts), and required forecasting lead time — the Flood EWS Dar es Salaam system is configured with a number of workflows through which relevant activities are carried out.

If only short lead times are required (e.g., the user needs to know what the water level will be in the next one to eight hours), water levels are estimated from simple relationships. For example, the future water level at the Jangwani Bridge is estimated from the currently observed water level at an upstream gauge for lead times up to about two hours, while lead times of up to eight hours can be reached with regression relationships against upstream rainfall only.

When longer lead times are required (e.g., the user needs to know what the water level or flooded area will be in the next five days), the rain that is forecast has yet to fall, and therefore hydrologic and hydraulic models, forced with numerical weather prediction (NWP) forecasts, will be established, which allow forecasts for water level and flood areas for seven days. It will use the already established models from earlier TURP projects as a baseline.

Users may also require different levels of model granularity. One user may need to know the forecast for a specific point location with a high temporal resolution (e.g., hourly), whereas another user may need the forecast aggregated over sub-wards at a lower temporary resolution (e.g., daily). The Flood EWS system has a number of transformation functions that allow for aggregation or disaggregation of the results to the required temporal and spatial resolution. The outputs from the Flood EWS Dar es Salaam feeding the CWW dashboard will be tailored to the requirements of the end users.

CHALLENGES AND LESSONS LEARNED

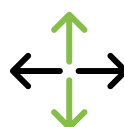
The 2019 rainy season was once again a destructive period. While EWSs are not yet at an operational stage, this year has served to validate use cases and test subsystems and

components of preparedness and response, such as the community mapping in support of impact assessments. Some specific challenges and lessons have been:

- The relocation of DMD and the National Emergency Operations Center from Dar es Salaam to Dodoma has left some uncertainties regarding the resources and functionality of the Dar es Salaam Emergency Operations Center, since these facilities were jointly located.
- A lack of government resources for the creation and activation of village-level disaster management committees mandated in the 2015 Disaster Management Act is a barrier to participation and effective activation of local level ward and sub-ward committees.



Pillar 3 Challenges



RELOCATION OF DMD AND
THE NATIONAL EMERGENCY
OPERATIONS CENTER



LACK OF GOVERNMENT
RESOURCES

FINANCIALS

Over FY19, Pillar 3 projects disbursed funding amounting to USD \$629,000, with a total program disbursement to date for this pillar of USD \$1,316,000. Financial summaries are detailed in Section 8.



Resilience Academy

A digital hub offering tools, knowledge and skills for resilience

“The pace of growth in the city was just going too fast for our old approaches. This is giving us an opportunity to reflect and mainstream new technologies and innovations — equipping the next generation in the process” - Dr. Ally Namangaya, Dean of SPSS, Ardhi University

OBJECTIVE

To maximize program impact and sustainability through the establishment of university partnerships that transfer skills and risk management tools to the next generation of urban planners.

OVERVIEW OF PROGRESS

As TURP passes its mid-point of operation, sustainability of programming has become a major focus. Conceptualized as a way to provide long-term impact of methodologies and best practices developed under TURP, the Resilience Academy is

ensuring that sustainability is realized through three key activities: (a) compiling data into a centralized and open database, (b) developing coursework to be embedded into university curricula, and (c) delivering training and capacity building on risk data and systems. This will ultimately support the expansion of the program across the country and the continent and is intended to improve understanding of the whole extent, exposure, and vulnerability of flooding at the community level.

In FY19, Resilience Academy operationalized engagement between Ardhi University, University of Dar es Salaam, State University of Zanzibar, and Sokoine University with support from University of Turku, and foundational activities were conducted.



ACTIVITY	STATUS	PROGRESS
Curriculum for Risk Mapping	ONGOING	The CRD is now available in geonode format at https://geonode.resilienceacademy.ac.tz and will be updated and managed by the Resilience Academy
Climate Risk Database for Research	ONGOING	Eight academic modules divided over four themes are currently in development, based on content of the Ramani Huria cookbook released in FY18
Capacity Building and Training in Risk Data and Systems	ONGOING	Industrial placement equipped over 500 students with community- mapping skills and tools Sustainability model now being prepared for institution-managed delivery through the Resilience Academy



CLIMATE RISK DATABASE

This activity is described in Pillar 1. However, it should be noted that the Resilience Academy, including all four engaged Tanzanian universities, has been active in building prior work and datasets curated by TURP. Specifically, team members have parsed various data repositories in 2019 to curate relevant data, update metadata and documentation, and ensure improved standards harmonization.

CURRICULUM FOR RISK MAPPING

Based upon the content of FY18's Ramani Huria cookbook, which was a review of the Ramani Huria approach to participatory mapping, eight academic modules related to risk mapping are now being developed. It is expected that, once finalized, these will be integrated into Tanzanian University curricula for the Master of Science (MSc) in GIS at Ardhi University and the MSc in Data Science at the University of Dar es Salaam (UDSM). They will also be published online through the Resilience Academy platform as open courseware.

INDUSTRIAL PLACEMENT

An annual Industrial Placement training program, delivered by the Ramani Huria team, has run from July to September each year since the inception of TURP. In 2018, increased demand led to the successful training of over 500 students from

multiple faculties at the Universities of Dar es Salaam and Ardhhi, up from 300 the previous year. These students were offered both classroom training and field-based practical skills on data collection, interviewing, surveying, and monitoring, and the amount of data that was collected through their involvement was unprecedented.



The 4 Module Themes



A Open data for resilience

MODULE 1 Geonode installation, tailoring, and maintenance
MODULE 2 Geospatial data quality, data management, and sharing
MODULE 3 Data visualization for resilience



B Flood Resilience in a Changing Climate

MODULE 4 Flood mapping, modeling, and predictions
MODULE 5 Climate change and resilience impacts



C Community Mapping for Improved Spatial Planning

MODULE 6 Participatory/community mapping methods and geospatial tools in spatial planning
MODULE 7 Ramani Huria community mapping practice



D Earth Observation for Resilience

MODULE 8 Machine Learning and AI methods in satellite and drone image processing, and mapping of exposure, hazards, and risks



Industry placement



02

MSC STUDENTS HAVE COMPLETED THEIR FIELD WORK AND TWO MORE WILL START IN SEPTEMBER 2019



MSC STUDENTS FROM TU DELFT AND DAR ES SALAAM UNIVERSITIES HAVE BEEN TRAINED AND SUPERVISED



THE MSC THESIS OF ONE OF THE STUDENTS IS EXPECTED BY DECEMBER 2019

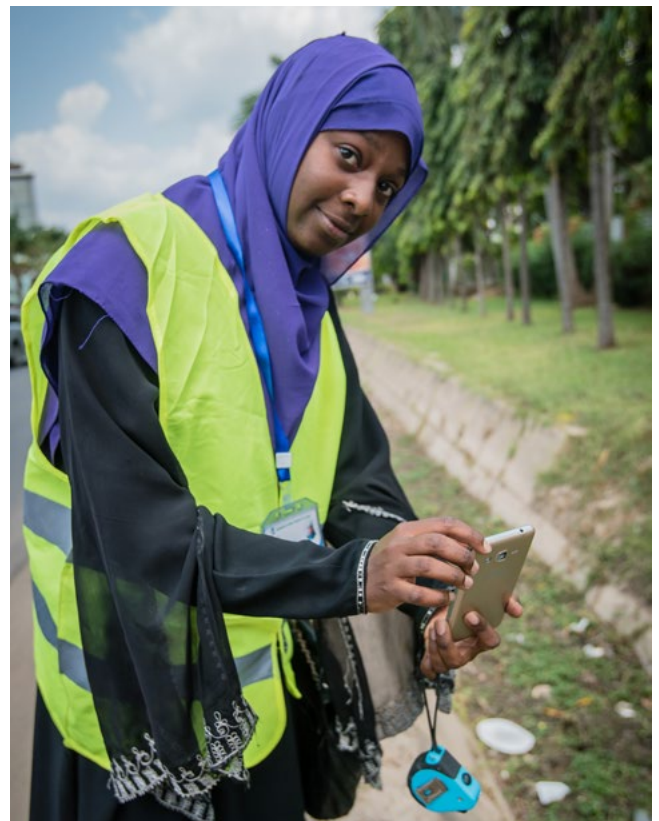


The Industrial Training Program offered by TURP continues to be the most popular choice for students at Ardhi University



Several students also took part in the solid waste mapping activities, through which they contributed to the collection of critical solid waste data being used to guide waste management in Dar es Salaam.

As the Ramani Huria project comes to a close, the Resilience Academy team is now working to develop a sustainability model for this training program by effectively integrating it into university curricula. The first iteration of training, supervised by the Tanzanian University partners, will take place from August through October 2019, and train a total of 150 Tanzanian students from UDSM, Ardhi, and State University of Zanzibar (SUZA).





CHALLENGES AND LESSONS LEARNED

The development of the Resilience Academy has been a collaborative process involving local and international partners. Challenges have been generally characterized by the sequencing and coordination needed between these parties as new ideas are introduced and consulted through various existing coordination mechanisms. Specific challenges are:

- **Formalizing partnership** – The concept for the Resilience Academy remains popular with universities, researchers, and prospective risk information partners. As such, there is a wide variety of possible collaborations that need to be assessed and prioritized. A consultation is currently underway with the four Tanzanian universities to determine the nature of formal requirement to join the Resilience Academy and what form of agreement is required. Ideally a template Memorandum of Understanding

(MoU) structure can be determined with associate guidelines for institutions to join and contribute course content, data, tools, researchers, or other resources.

- **Oversubscribing Industrial Placement again** – The placement in industry of 550 students during July – September 2018 was at an unprecedented level, with university departments requesting to submit more. For the 2019 placement process, only 150 students could be accommodated, as much greater emphasis has been placed on achieving a spread of departments and transferring the mechanisms for selection, training, supervision and assessment of students from Ramani Huria to the university departments. Developing a financial plan for future iterations is under discussion and will be important for sustainability.



ResilienceAcademy Challenges



FORMALIZING PARTNERSHIP



OVERSUBSCRIBING INDUSTRIAL
PLACEMENT

FINANCIALS

In FY19, RA projects were allotted funding from one grant: TF0A4238 Resilience Academy. Funds disbursed through this grant amounted to USD \$230,862.

Financial summaries are detailed in Section 8.

Program Management

OBJECTIVE

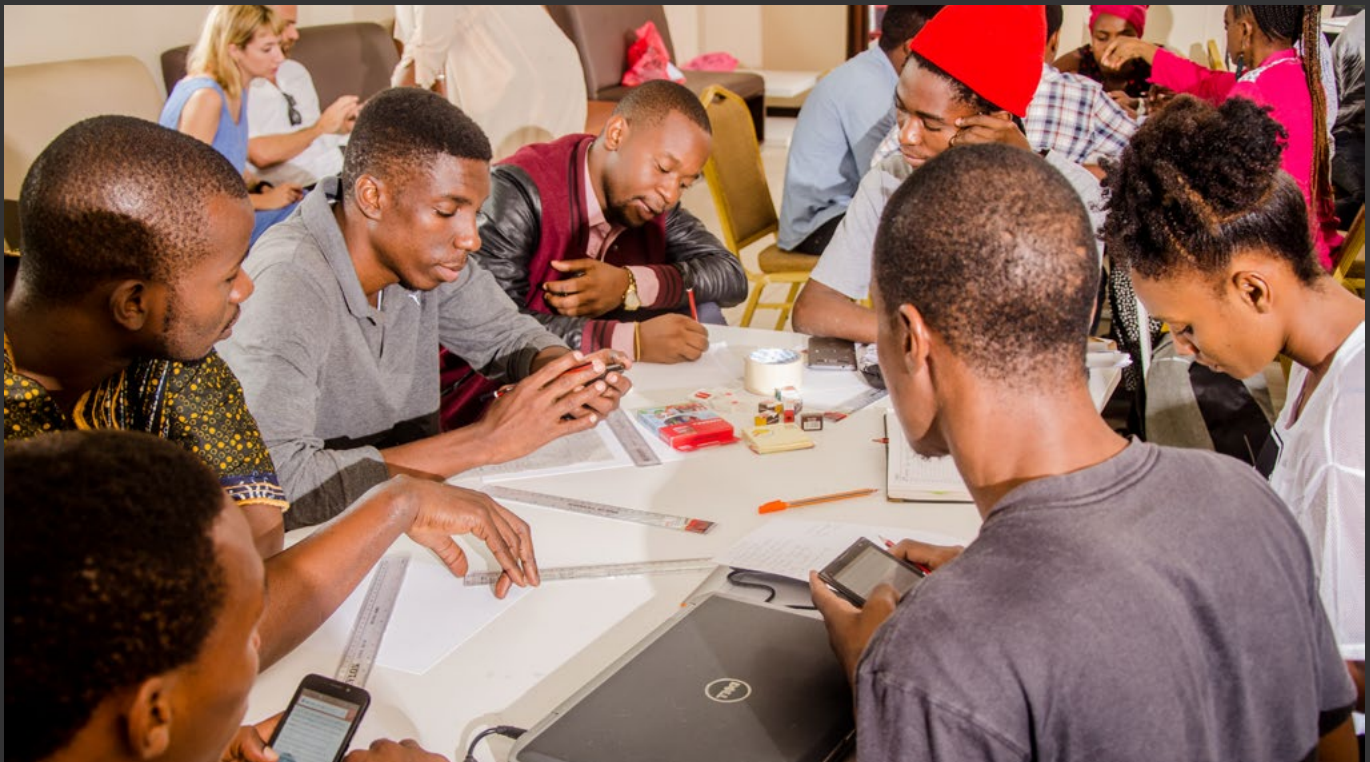
Program management and administrative activities for the TF include, but are not limited to, supporting program governance arrangements and TF-related meetings; planning and executing work plans and budgets; managing communication and conducting outreach; disseminating lessons learned; reporting on progress; and monitoring and evaluating the program.

OVERVIEW OF PROGRESS

During FY19, activities continued under all four Pillars of TURP, demanding attentive coordination from the program management team. Given the high level of activity and interactions, efforts during FY19 have focused

on maintaining coordination across the program team and between program partners, while also broadening the reach of program communications. These included:

- Coordination of monthly internal team meetings with a rotating focus on Pillars
- Management of an online collaborative digital repository for program information
- Implementation of a media communication strategy, including the development of collaborative stories with the World Bank and external partners, and continued production of a short video documentaries on program achievements
- Delivery of a series of community engagement initiatives to integrate students, artists, and other groups into dialogue on urban resilience



ACTIVITY	STATUS	PROGRESS
International conference	COMPLETE	URTZ 2018, TURP's annual conference, took place in August 2018 at the Julius Nyerere International Convention Centre as a collaborative event with the Free Open Source Software for Geospatial (FOSS4G) community
Steering Committee meetings	COMPLETE	1 meeting conducted in February 2019
Technical Advisory Committee meetings	COMPLETE	1 meeting conducted in June 2019
Annual review and annual work plan update	ONGOING	Preparation for the annual review is ongoing – to take place in September/October 2019
Communication	ONGOING	Narrative below

COMMUNICATION

External Communication

Over FY19, the priority of TURP communications shifted from strategic design to implementation, with a goal of extending the reach of program communication beyond partner communities. To achieve this, the communications team moved beyond the use of communications as a public relations tool towards conceptualizing and implementing a series of impactful community engagement initiatives.

The first of these was a mural challenge, which introduced the local arts community to the concept of urban resilience by inviting artists to produce engaging works that tackled the topic. The challenge commenced by engaging over 50 artists in a dialogue on disaster risk in Tanzania and the critical role that the creative community can play in envisioning solutions. After the two-day workshop, 33 artists submitted proposal pieces to be considered for translation into large-scale murals.

Ten pieces were then shortlisted and incorporated into an exhibition, which was held at the 2018 Understanding Risk Tanzania (URTZ) conference

at Julius Nyerere International Convention Centre. The winning piece, based on the results of a public vote, was painted upon a wall in a high-traffic area within Dar es Salaam's most flood-prone ward, where it continues to ignite public discussion on resilience.



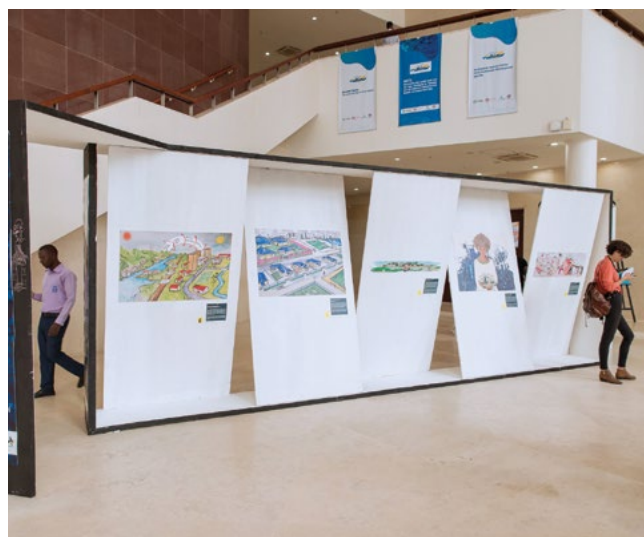


“I believe my art can impact society, and I feel happy when I see a change that my art has brought to the community. Most people are blind to important issues like climate change, but, if they see art, they will get the message clearly.”

– Nickson Jeremiah, Mural Challenge Artist

The second scheduled engagement was a Disaster Risk Reporting workshop, hosted in partnership with the Disaster Risk Network of African Journalists (DIRAJ). This activity trained regional journalists on reporting standards and techniques used within the international disaster risk community, emphasizing the important role of the media in effectively communicating risk to the public. Ten local and five international journalists (from Kenya, Uganda, and Rwanda) attended the training, which took place as part of URTZ 2018.

During the conference, the journalists were exposed to the position of disaster risk-reduction within current affairs and gained a better understanding of its connection with other major global issues such as migration, food shortage, and health.



| In FY19, TURP comms extended the reach of dialogue on urban resilience through community engagement activities

Their involvement improved public awareness on conference proceedings, with active use of the hashtag #URTZ2018 achieving impressions exceeding 1.4 million

Following the event, the training participants collaboratively produced long-form stories on the topic of risk and resilience in Tanzania, which were shared widely across the East African region.

TURP's communication team worked to extend this journalistic engagement over FY19 by connecting with local (Azam Television, The Citizen, The Guardian) and international (BBC,

Spectrum, National Geographic) news agencies. It is expected that, through their stories, a global audience in the hundreds of thousands have now accessed information related to the program and to disaster risk-reduction in Tanzania.

Publishing also continued through the World Bank platforms, upon which three stories and three videos related to TURP were shared during the FY. The outward-facing TURP website was updated to include these stories and reflect program progress and changes.



Crowd poses in front of winning mural.

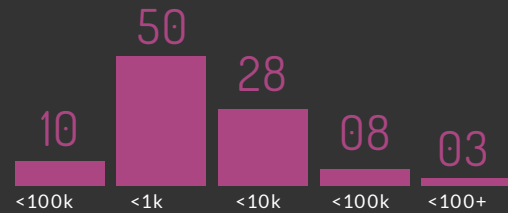
URTZ Estimated Reach



658,014
ACCOUNTS REACHED

1,448,756
IMPRESSIONS

EXPOSURE

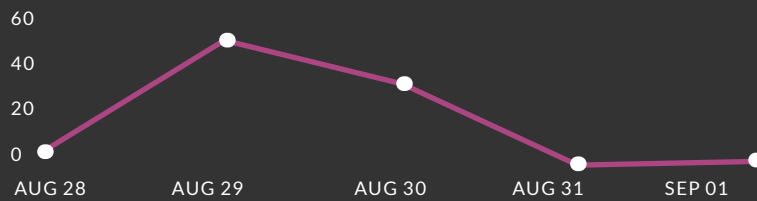


ACTIVITY

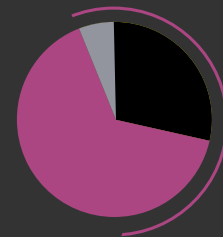
100
TWEETS

36
CONTRIBUTORS

5
DAYS



05 REPLIES



29 TWEETS

66 RETWEETS

The hashtag used to promote URTZ 2018, #URTZ2018, achieved impressions exceeding 1.4 million



Spotlight Story

The Art of Resilience





In 2018, local artists were challenged by the TURP to engage in the “art of resilience” using creativity to envision a Dar es Salaam that is resilient to climate and disaster risk.

“As agents of cultural shift, art and artists raise the alarm; they raise consciousness; and they raise spirits. They bring us to our senses, helping us to feel, think, and see differently. They are portrayers of the possible, provoking and informing the imagination of states beyond present conditions, and conveying the promise and potential of transformation. The movement towards greater urban resilience has begun, and it involves multi-sectoral efforts to manage complex challenges. It is co-creative. The art of resilience could be restated as the art of learning to live together as though our future really mattered. Writers, musicians, filmmakers, architects, designers must engage us all, whether as audience, students, or collaborators, in co-creating a new narrative for humanity.”

- Excerpt from a dialogue supported by Musagetes, the J.W. McConnell Foundation (Montreal) and the Breuninger Stiftung (Berlin) on Art and Resilience

In 2018, local artists were challenged by the TURP to engage in the “art of resilience” using creativity to envision a Dar es Salaam that is resilient to climate and disaster risk. The challenge attracted 33 proposals for a large-scale mural to encourage public dialogue on the subject. Applicants were given a chance to attend a two-day workshop to better understand the complex notion of urban resilience and how art can help to tackle it. The top 10 had the opportunity to present their designs during URTZ 2018, where conference participants voted for their favorites to be painted on a wall in the flood-prone Jangwani area of Dar es Salaam.

➤ The Top Two

➔ Isack Amini Architecture, Student + Artist, University of Dar es Salaam, 23



"My advice to young artists in Tanzania is to use their talent, stay hungry, and do what it takes to make a positive impact on your community."

Isack Amini won the Resilient Dar Mural Challenge with an intricate design that reflected his deep connection to the topic.

"This victory means a lot to me because I see my design touching lives and giving hope to the people of Jangwani and the Msimbazi valley," said Amini. Amini makes use of his talent to sketch, draw, and paint people, and design residential houses, but also spends a significant amount of time volunteering on urban activities. He says that he saw a window of opportunity through this challenge to engage in art as a way of inspiring and motivating his generation.

➔ Nickson Jeremiah Graphic Designer + Artist, Arusha, 19



"This is the greatest achievement for me as an artist. I believe my art can impact society and I feel happy when I see a change that my art has brought to the community. Most people are blind to important issues like climate change, but, if they see art, they will get the message clearly."

The runner-up was Nickson Jeremiah, a 19-year-old who travelled all the way from Arusha to Dar es Salaam to participate in the challenge after finding an advertisement online.

Jeremiah was inspired by the opportunity to use his talent to address challenges posed by climate change and disaster risk.

He notes that climate change most severely affects women in his village who have to endure long journeys to fetch water, collect firewood, and are relied upon to take care of the family - particularly in times of disaster.

"My illustration features a girl (the dreamer) holding the city of her dreams, a green city full of trees, clean water — a well-planned city that she can call home. She is calling upon the community to join hands in bringing her dreams to reality," Jeremiah explained.

Jeremiah completed his ordinary secondary education in 2017 and attained a scholarship at his dream school in Dubai, but it wasn't enough to convince his move. Instead, he took courses online and continues to do research on YouTube and Pinterest to get ideas and improve his skills as an artist.

He dreams of becoming not just a professional artist, but an artist that influences change through his work.

OUTPUT	CATEGORY	LINK
Collaboration for Development	WEBSITE	https://collaboration.worldbank.org/groups/tanzania-urban-resilience-online-community
TURP Website	WEBSITE	http://www.worldbank.org/en/programs/tanzania-urban-resilience-program
Ramani Huria Website	WEBSITE	http://www.worldbank.org/en/news/feature/2018/03/09/elevating-emergency-response-in-tanzania
Resilience Academy Website	WEBSITE	https://resilienceacademy.ac.tz
Community Risk Database/Geonode	WEBSITE	https://geonode.resilienceacademy.ac.tz
TURP YouTube Channel	YOUTUBE CHANNEL	https://www.youtube.com/channel/UCC-8Wdo9CUFBj2UjAKwgvgug
TURP/URTZ Social Media	SOCIAL MEDIA ENGAGEMENT	https://tweetreach.com/reports/21824121
Citizen science for reduced flood risk in Tanzania	WB FEATURE STORY	https://www.worldbank.org/en/news/feature/2019/05/15/in-tanzania-citizen-scientists-help-reduce-flood-risk-with-soil-sampling
Why do people live in flood prone areas – reflections from Dar es Salaam	WB FEATURE STORY	https://blogs.worldbank.org/nasikiliza/why-do-people-live-in-flood-prone-areas-reflections-from-dar-es-salaam
Envisioning Urban Resilience for Tanzania	WB FEATURE STORY	https://www.worldbank.org/en/news/feature/2018/10/15/envisioning-urban-resilience-for-tanzania
Jangwani Dreaming	EXTERNAL STORY	http://diraj.org/jangwani-dreaming-hope-for-dar-poor-neighborhood-as-work-set-to-start-on-slum-upgrade/
Paint My Tomorrow	EXTERNAL STORY	http://diraj.org/paint-my-tomorrow-dar-es-salaam/
Bonde La Msimbazi	EXTERNAL STORY	https://www.youtube.com/watch?v=jCBRjBUSWUc
New plan in place to address Dar's flooding woes	EXTERNAL STORY	https://www.ippmedia.com/en/news/new-plan-place-address-dar-s-flooding-woes-during-rainy-seasons
Student attends URTZ Conference	EXTERNAL STORY	https://www.suaso.sua.ac.tz/?p=1698
January Makamba officiates meeting on Tanzania Urban Resilience	EXTERNAL STORY	https://threadreaderapp.com/thread/1035241618184519685.html
John Bevington travels to Tanzania for URTZ 2018	EXTERNAL STORY	https://www.jbaconsulting.com/knowledge-hub/john-bevington-travels-to-tanzania-for-the-urtz-2018-conference/

Tanzania builds a local drone industry	EXTERNAL STORY	https://spectrum.ieee.org/robotics/drones/tanzanias-homegrown-drone-industry-takes-off-on-bamboo-wings
Tackling Dar es Salaam's waste problem one dataset at a time	EXTERNAL STORY	https://www.ippmedia.com/en/features/hot-tackles-dar-es-salaam's-waste-problem-one-dataset-time
Local graduate using drones for mapping	EXTERNAL STORY	https://www.thecitizen.co.tz/magazine/success/-Local-graduate-using-drones-for-mapping/1843788-4967500-c6pj0rz/index.html
Local graduates develop bamboo drone	EXTERNAL STORY	https://www.bbc.com/swahili/bbc_swahili_radio/w172wwnjfs4sb32
Mapping Africa's megacities	EXTERNAL STORY	https://www.bbc.co.uk/programmes/w3cswgqx
Trash mapping and local impact	EXTERNAL STORY	https://www.youtube.com/watch?v=Y77bwq8XnJM
This Tanzanian city may soon be the world's most populous	EXTERNAL STORY	https://www.nationalgeographic.com/environment/2019/04/tanzanian-city-may-soon-be-one-of-the-worlds-most-populous/

INTERNAL COMMUNICATION

During FY19, internal communication was maintained through TURP's Collaboration for Development platform and committee meetings.

Recognizing a gap in interaction between project leads, monthly internal meetings were introduced. Each meeting focused on a different Pillar, featuring presentations from project leads and a progress overview from TURP management. This improved team cohesion and enabled collaboration.

Several presentations were also delivered during the FY to improve awareness of program initiatives within the broader communities associated with the World Bank team and program partners. These presentations, curated by the local team, captured the attention of prominent institutional figures, including the World Bank Urban Director, Sameh Wahba, and the World Bank Vice President for Africa, Hafez Ghanem, and achieved program buy-in from key ministerial officials within Tanzania.





| January Makamba attends URTZ 2018.

EVENTS

TURP events are essential to the sustained engagement of partners, beneficiaries, and the general public and to the promotion of resilience as a critical consideration in development planning.

URTZ 2018, the program's annual conference, was the first event of the FY, kicking off program activities at the Julius Nyerere International Convention Centre. Over two days, it brought together over 300 stakeholders, students, and beneficiaries to imagine the future of urban resilience in Tanzania and featured presentations from relevant local and international initiatives.

"We are twins conjoined at the heart on this issue. And so we can learn a great deal from our different approaches." - Charles K'onyango, National Director of Urban Development, Kenya

While Day 1 of the conference gave an overview of interventions being implemented across Tanzania to improve risk identification, risk



Notable Mentions



January Makamba @JMakamba 11 months ago
RT @JBAConsulting: The #African Minister for #Environment is speaking at #URTZ2018 - "#DaresSalaam is leading the pack of fastest growing c...



World Bank Tanzania @WBTanzania 11 months ago
RT @edwardcanderson: Understanding Risk Tanzania conference has kicked off at #URTZ2018 our illustrious steering committee is giving their...



Crowd2Map Tanzania @Crowd2Map 11 months ago
RT @DirajAfrica: Panel discussion: Towards a resilient Tanzania #URTZ2018 #FOSS4G2018 #UrbanResilience @WBTanzania @unisdr @UNISDR_Africa h...



JM Liotier (day 15511 of your 30-day free trial) @liotier 11 months ago
RT @Dapper Mapper: The democratic process of participatory urban planning to reduce flood risk in Tanzania is changing the risk perceptions...



Manumbu Mtani @MtaniManumbu 11 months ago
"If tools doesn't not save #Humanity then it's simply just like a toy" By. Honorable January Makamba Minister of En...
twitter.com/i/web/status/1...

reduction, and emergency preparedness, Day 2 focused specifically on the subject of resilience for urban rivers and surrounding land. This involved a panel of case studies from Dar es Salaam, Mozambique, and Kenya. The Msimbazi Charrette design process was presented in detail, and honorary guests Bella Bird (World Bank Country Director), Beth Arthy (Head of DfID Tanzania), Hon. Minister January Makamba, Hon. Minister Selemani Jafo, and 33 Members of Parliament were taken on a walk-through of the project's initial outputs.

During the remainder of FY19, a number of smaller-scale events were conducted, many of which improved public awareness and support for the Msimbazi Opportunity Plan.

“We are twins conjoined at the heart on this issue. And so we can learn a great deal from our different approaches.”

- Charles K'onyango, National Director of Urban Development, Kenya



URTZ 2018 engaged 300+ stakeholders, students, and beneficiaries through panel discussions and technical sessions on urban resilience

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Results Overview



05

Result indicators are detailed in the table below. Targets described in the indicator column are for the calendar year and, as of this report, cover the FY up to June 30, 2019.

Indicator A.1 refers to both the identification and implementation of risk-mitigation measures. The identification of measure has been directly achieved through the Ramani Huria community assets and flood risk-identification process, which covered 49 wards and 243 sub-wards. The pathway to implementation of measures was expected to take several forms: via the normal government process of local government planning (Opportunities and Obstacles to Development¹), via community-level small works and grants, and via the anticipated Msimbazi Flood Risk Reduction program. As both the community works and the larger Msimbazi program are pending government approval, there has not been a direct line of TURP financing to implementation of work. Indirectly, work and actions have been undertaken by several wards following TURP planning and engagement activities, but have not been quantified to date.

Indicator A.2 is expected to be assessed in August 2019 and published in the September 2019 Disaster Risk Management Index Assessment Report.

Indicator A.3 is pending the first runs of the Probabilistic Risk model for Dar es Salaam, which is under procurement and as such, an average annual loss (AAL) has not yet been established using the most recent data. Socioeconomic analysis performed around the April 2019 flood event, however, which largely affected the Msimbazi basin communities, modelled an estimated loss of USD \$107,027,000 to USD \$227,685,000. In addition, the hydraulic

model, which provided for hazard parameters (flood duration, depth) demonstrates significant floodwater reductions with interventions proposed from the risk-planning charrette process. Hence it is considered very likely that the probabilistic model run will demonstrate a reduced AAL for the Msimbazi basin under risk-mitigation measures proposed, compared to without.

Indicator B.1 has been updated to reflect the results of household surveys whereby exposure to floods is widespread in Dar es Salaam; 39% of the population, or 2 million people, have been impacted either directly or indirectly by floods in the past. This estimate is based on self-reported exposure to floods (including the 2018 flood) and computed by applying sample weights, assuming selection strategy was successful in capturing representativeness of flood risk in Dar es Salaam. An alternative methodology from Ramani Huria calculated that a population of 3,310,000 live within the 49 wards covered by the exposure mapping, which itself focused on the more flood-prone areas. Hence, it is expected that a majority of these wards will be vulnerable to flooding.

Indicator 2.2 is expected to be on track for 20 sub-ward community plans by end of 2019. Currently, however, only three ward-level plans, comprising 12 sub-ward plans, are completed. This is a result of a restructuring of the community disasters management committee activation process into a pilot phase in 2019. Great focus placed on ward-level committees has led to better vertical integration between sub-wards and wards, but led to slow roll-out of plans to additional sub-wards.

Indicator 3.1 concerns the Emergency Operation Center. A needs assessment and structure recommendations have been submitted to GoT for review.

¹ <https://www.participatorymethods.org/resource/training-manual-participatory-community-based-ood-opportunities-and-obstacles-development>



Results Log Frame

Targets Indicate Fiscal Year to June 30, 2019

INDICATOR	BASELINE	FY18 / Target	FY19 / Target	DATA COLLECTION AND REPORTING			COMMENT
				FREQUENCY	DATA SOURCE	RESPONSIBILITY	
IMPACT INDICATORS Urban areas in Tanzania are more resilient to climate risk							
I.1 Number of wards benefiting from or implementing flood risk mitigation measures identified in ward level risk management plans	0	0 / 10	3 / 15	Annually	Regional Administrative Secretary	PO-RALG and ULGAs responding to expert-led survey	Tracks the extent to which structural and non-structural risk-reduction measures are identified in local government plans and implemented
I.2 Improved capacity of government agencies to identify, reduce, finance and cope with disaster risks	Low	TBD / Incipient	TBD / Appreciable	Annually	Disaster risk management index	PO-RALG and ULGAs responding to expert-led survey	Weighted index of advances made in intermediate outcome indicators for Pillars 1, 2, and 3. Assessment based on Dar es Salaam and including measures for financial protection.
I.3 Modeled Economic losses in the Msimbazi basin reduced as a result of structural risk mitigation measures designed		TBD/NA	Probabilistic Model runs not yet available. April 2019 flood costs at USD \$100 million / current Hydraulic model demonstrates significant flood hazard reduction from Msimbazi interventions PML for 2017 exposure reduced under planned works scenario	Model Runs expected in 2019 and 2020. Also contingent on selection of structural measures implemented.	Probabilistic Flood Risk model using TURP exposure and hazard data.	World Bank	AAL to be determined from flood risk model expected in 2019. 2017 baseline data is taken from Turpie et al. (2016) model and may be subject to revision once new model is calibrated. No indicator is expected for collection yet.
OUTCOME INDICATORS Urban local governments in Tanzania utilize improved evidence base and urban planning to strengthen resilience to climate-related hazards							
B.1 Number of persons benefiting from improved flood resilience as a result of ICF support	0	350,000* / 250,000	2 million exposed / 500,000	Annually	Flood risk and exposure model	World Bank	Population estimate based on census data, household data, associated with dwellings and businesses exposed to flood hazards and modeled to expect reduced losses as a result of ICF interventions (e.g., new/improved drains, EWSs, and/or flood shelters) (Dar es Salaam only).
B.2 Extent to which Investment Climate Facility (ICF) intervention is likely to have a transformational impact	0	TBD / 2	TBD / 3	Annually	Annual Review	DFID	Narrative report made during DFID Annual Review process. A score of 'A' was assigned in November 2018. A score for FY19 will be assigned in November 2019.
INTERMEDIATE RESULT INDICATORS							
PILLAR 1 RISK IDENTIFICATION							
I.1 Improved access to climate risk information in Dar es Salaam	Not yet available	21 wards published: exposure, drainage, inundation hazard / Risk information published for 20 wards of Dar es Salaam with flood inundation scenarios	All 49 urban wards published: exposure, drainage, inundation hazard / Risk information published for 70 wards of Dar es Salaam with flood inundation scenarios	Annually	Based on indicators 3.1 - 3.4, 4.3, and 4.6		A geospatial data portal will serve as a repository for information at both national and sub-national levels.

1.2 Exposure and risk assessments applied in major cities (cumulative number)	0	Pilot service concluded and under evaluation. Monitoring service under discussion with stakeholders / At least 1 monitoring service demonstrated, at least 1 more urban risk service under preparation demonstrated, at least 1 more urban risk service under preparation		Annually	Climate risk geonode repository	P0-RALG	Standardized exposure, hazard, and risk-monitoring tools will be developed first as pilots and applied across urban centers. These services will serve as a monitoring tool for investment needs (build-up of vulnerable population in hazard areas), baselines for exposure populations, and a support tool for development and improved land use planning.
PILLAR 2 RISK REDUCTION							
2.1 Cumulative number of people directly engaged in climate risk reduction activities - number and percentage of females (WB core indicator)	0	1522 / 100	6102 / 250	Annually	Participant lists and registrations from training and events	World Bank	This indicator is a targeted and high-intensity ICF Indicator that tracks the training of individuals in understanding risk information, analyzing and applying risk data
2.2 Community risk reduction plans developed using improved risk information (cumulative number)	0	0 / 10	12 / 20	Annually	Ward Offices and LGAs	World Bank	This indicator directly tracks the progress of risk-reduction planning on a community level.
2.3 Government risk reduction activities	0	Msimbazi Flood Model Accepted by Stakeholders	Msimbazi Flood mitigation works grant pending	Annually	Secretariat	World Bank	This indicator tracks government endorsement of TURP supported risk-reduction activities in the Msimbazi Basin.
PILLAR 3 PREPAREDNESS AND EMERGENCY MANAGEMENT							
3.1 Dar es Salaam Emergency Response System	0	Detailed Trainings, Exercises and Drills program procured	Emergency Operations Center Structure recommended	Annually	DarMAERT	Disaster Management Department and World Bank	This indicator tracks: <ul style="list-style-type: none"> City Emergency Management authorities adopting and using a City Emergency Response plan; and Enhancing Emergency response system through Standard Operating Procedures and Emergency Operations Center Enhancing Emergency response system through Standard Operating Procedures and Emergency Operations Center
RESILIENCE ACADEMY KNOWLEDGE TRANSFER ESTABLISHED							
4.1 Cumulative Number of staff and students (by gender) placed in Urban Resilience Industry placement	0	829 Total 363 female / 500	1126 Total 567 female / 750	Annually	Tanzanian Universities	Disaster Management Department and World Bank	This indicator tracks the number of Tanzanian university students in fields of urban planning, GIS, geography attaining a 10-week immersion in risk data, community engagement and risk-analysis techniques required to sustain risk information activities and useful in local governments.
4.2 Climate Risk Data and Tools Use in research	0	In progress / Geospatial Data repository established for 4 universities	Geospatial Data Repository Published on Resilience Academy. Software tools in progress / Source Code for InaSafe and Risk Model hosted for Universities	Annually	Tanzanian Universities	Disaster Management Department and World Bank	This indicator tracks availability, access, and use of risk information in research; thus monitoring demand for risk data from academia and research partnerships in Tanzania on resilience.
PROGRAM ADMINISTRATION							
5.1 Program management, knowledge and communications	0	Program Committee Meetings Held; Technical Conference scheduled August 2018	Technical Conference Held; Program Outputs Reviewed	Annually	Secretariat	World Bank	This indicator tracks reporting milestones and dissemination

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Risks Overview

06



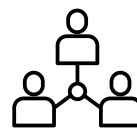


STAKEHOLDER ENGAGEMENT AND PRIORITIES

The multi-stakeholder nature of TURP has presented fewer challenges this past year, as the program is better known as communication channels and engagement has continued to roll out. However, risks of conflicting priorities remain and TURP retains an important multisectoral convening role.

This is evident in the case of scarce land allocation for competing priorities, such as in the city center where needs for urban sanitation, transport facilities, flood retention basins, and community space for recreation, agriculture, and livelihoods need to be carefully balanced. The forthcoming year may present additional challenges arising from it being an election year, putting added pressure on government counterparts.

⏏ Risks Overview Focus



STAKEHOLDER ENGAGEMENT AND PRIORITIES



FINANCIAL MANAGEMENT AND PROCUREMENT



ENVIRONMENTAL, SOCIAL, AND SECURITY

A recurring challenge has been the significant flood impacts, with each year seeing several significant flood events. Although no flood emergency was declared in 2019, three major floods occurred in March, April, and May. The results of the geomorphology and erosion assessment conclude that these flood events will increase in frequency and severity under a business-as-usual scenario. If major dredging work, associated riverbank stabilization, sediment management, and water retention interventions do not begin before the next rainy season, then Dar es Salaam can expect to deal with shocks from repeated flood events.

FINANCIAL MANAGEMENT AND PROCUREMENT

The pound sterling has fallen further against the U.S. dollar in 2019, which will impact the resources for TURP. The year ahead foresees ongoing uncertainty and potential volatility in the UK pound and hence there will be a need to revise TURP commitment projections and coordinate closely with UKaid on budget transfers.

The challenge of sequencing expenditures in the first three months of the calendar year, which had been flagged in past TURP reports, is expected to improve this year. Nevertheless, pre-flood season can raise unforeseen needs relating to preparedness, and carefully planning for contingency adjustments will be required in order to respond to shocks.

ENVIRONMENTAL, SOCIAL, AND SECURITY

TURP has worked with the GoT and key implementing agencies to highlight relevant environmental and social concerns and ensure that, where applicable, World Bank safeguard policies are adhered to.

The year ahead is expected to focus on a few specific environmental concerns: the health of the Dar es Salaam mangrove and river estuary environment, as well as the soil toxicology and pollution study. Results from these assessments may pose a need to redesign interventions or develop additional mitigation measures.





우리 **생명**은
세상보다
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Looking Forward



07



WORKPLAN OVERVIEW

The projection for the World Bank-executed activities in FY20 is similar to FY19 overall. A change in emphasis, however, is expected within the Pillars.

For Pillar 1, the majority of work will focus on the Probabilistic Risk Model, which is expanded in scope to also address the secondary city of Stonetown in Zanzibar. Other Pillar 1 activities are scaling down in Dar es Salaam or moving towards additional cities. It was originally anticipated that the GoT-executed programs would be effective at this stage to pick up on ongoing risk monitoring and surveying campaigns, and hence within the Pillar there is some uncertainty on the timing of handover activities and uptake from the GoT programs. TURP will endeavor to maintain continuity of urban monitoring networks and surveys, including sediment volumetric surveys, building stock updates, and river flow monitoring, and this may involve extending the World Bank-executed activities until the GoT programs are in place.

The year ahead is also expected to conclude the major planning processes spearheaded by the Msimbazi Design Charrette and focus more on local and municipal government processes.

However, significant work is expected on a just-in-time basis as need arises. One example anticipated is the need to study the ecology impacts to the mangrove ecosystem and assess planning and land management options. While another World Cleanup event is expected in September 2019, a similar exercise to last year is not expected, as waste management support is mainstreamed as far as possible.

Pillar 3 activities can be expected to increase as more extensive training, exercises, drills, and early warning activities are rolled out. It is also important to note the need for contingency in dealing with potentially severe flood events or other shocks that may arise, in which case support to damage assessment and recovery may also increase significantly.

The RA will also see more progress over the coming FY as activities are commenced, more partners and universities are engaged, and local labs are capacitated.

Finally, as TURP is transitioning through its mid-point, administration of the program is expected to move from peak procurement into peak delivery mode, with many activities entering an evaluation and phase-out while some new engagements are developed. Hence, staffing can be expected to see an increase during the FY for this peak.



Workflow

Targets Indicate Fiscal Year to June 30, 2019

TOTAL	\$3,822,000	\$3,470,000
	FY19 Disbursement	FY20 Disbursement
PA Program Management	\$50,000	\$50,000
TA Program Coordination & Quality Assurance	\$50,000	\$25,000
Knowledge Sharing	\$0	\$25,000
Pillar 1 Risk Identification	\$1,148,000	\$1,560,000
Historical Events Inventory	\$0	\$125,000
Disaster Risk Management Index & Updates	\$185,000	\$100,000
Elevation Model and Exposure Mapping	\$108,000	\$0
Ramani Huria (Community Mapping) additional cities	\$58,000	\$55,000
Satellite Data Mapping additional Cities	\$268,000	\$250,000
Erosion and Sedimentation Study	\$45,000	\$125,000
Hydrological Study & Monitoring	\$85,000	\$125,000
Spatial Data Management & Hosting	\$198,000	\$125,000
Dar es Salaam Probabilistic Flood Risk Evaluation	\$38,000	\$655,000
Pillar 2 Risk Reduction	\$1,034,000	\$595,000
Risk Mitigation Planning	\$253,000	\$275,000
Msimbazi Flood Model & Infrastructure Diagnostic	\$0	\$0
Just In Time Technical Assistance	\$150,000	\$125,000
Land Use Planning and Resettlement Framework	\$20,000	\$0
Municipal DRM Plans	\$28,000	\$150,000
Drains Maintenance & Management dashboard	\$55,000	\$0
Msimbazi Design Charrette and Special Planning Area	\$406,000	\$0
Msimbazi charrette and area plan	\$250,000	\$0
Msimbazi River Basin management Plan	\$156,000	\$0
Community Level Risk Reduction	\$375,000	\$320,000
Participatory climate risk plans, training, behavior change	\$275,000	\$320,000
World Clean Up Day	\$100,000	\$0

Pillar 3 Disaster Preparedness &Emergency Management	\$629,000	\$745,000
Municipal Contingency Plans	\$20,000	\$125,000
Community Response Plans	\$125,000	\$100,000
Training, Exercises and Drills	\$125,000	\$125,000
Damage Assessment Capacity building	\$105,000	\$65,000
Early Warning and Forecast	\$250,000	\$285,000
Local Early Warning and Early Action Tool	\$100,000	\$125,000
Forecast and Flood Advisories	\$150,000	\$160,000

Resilience Academy	\$515,000	\$600,000
Curricula & Courses for Risk Information	\$220,000	\$190,000
Support to Placement in Industry Program	\$138,000	\$140,000
Support to Master's Students & Exchanges	\$30,000	\$45,000
University Resilience Labs & Equipment	\$0	\$125,000
Short Courses and Capacity Building	\$125,000	\$100,000

Secretariat	\$446,000	\$425,000
International conference series	\$160,000	\$95000
Steering committee meetings	\$5,000	\$5000
Communications, Websites, and Media	\$70,000	\$38,000
M&E Baseline Data Collection	\$12,000	\$12,000
Publications (update resilience report/editing/printing)	\$32,000	\$12,000
Annual Review	\$12,000	\$12,000
Staffing	\$155,000	\$250,000

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Financials



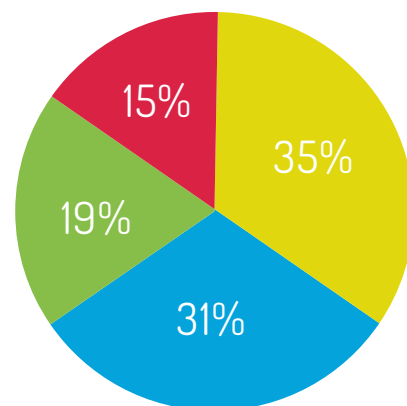
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FINANCIAL OVERVIEW

Total disbursements to date from the TF amount to USD \$8,384,000. In FY19, a total of USD \$3,834,000 was disbursed, with USD \$1,131,000 remaining available.

Outstanding commitments of USD \$2,118,000 will be carried over into the next fiscal year.



● PILLAR 1
 ● PILLAR 2
 ● PILLAR 3
 ● RESILIENCE ACADEMY

| Distribution of TURP Project Pillar Funds in Fiscal Year 2019



Financial Overview

Indicate Fiscal Year to June 30, 2019

	REPORTING PERIOD ENDED JUNE 30, 2019 (USD)
Total Funds Received from DfID as of June 30 2019	\$11,638,000
Disbursements FY19	\$3,822,000
Total TF Disbursements	\$8,384,000
Outstanding Contract Commitments	\$2,118,000
Cash Balance at the End of Fiscal Year 2018	\$1,136,000



Disbursements

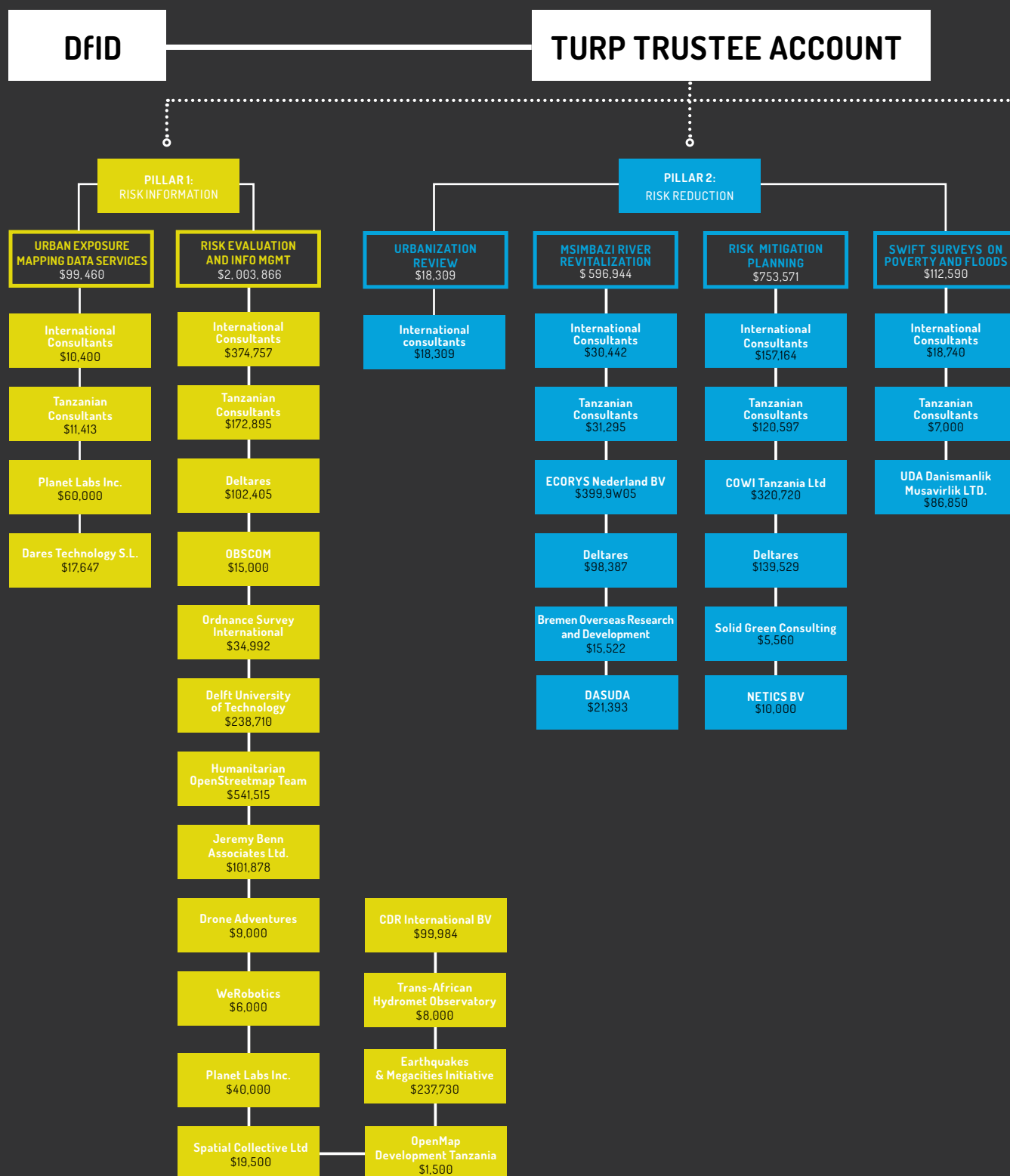
Indicate Fiscal Year to June 30, 2019

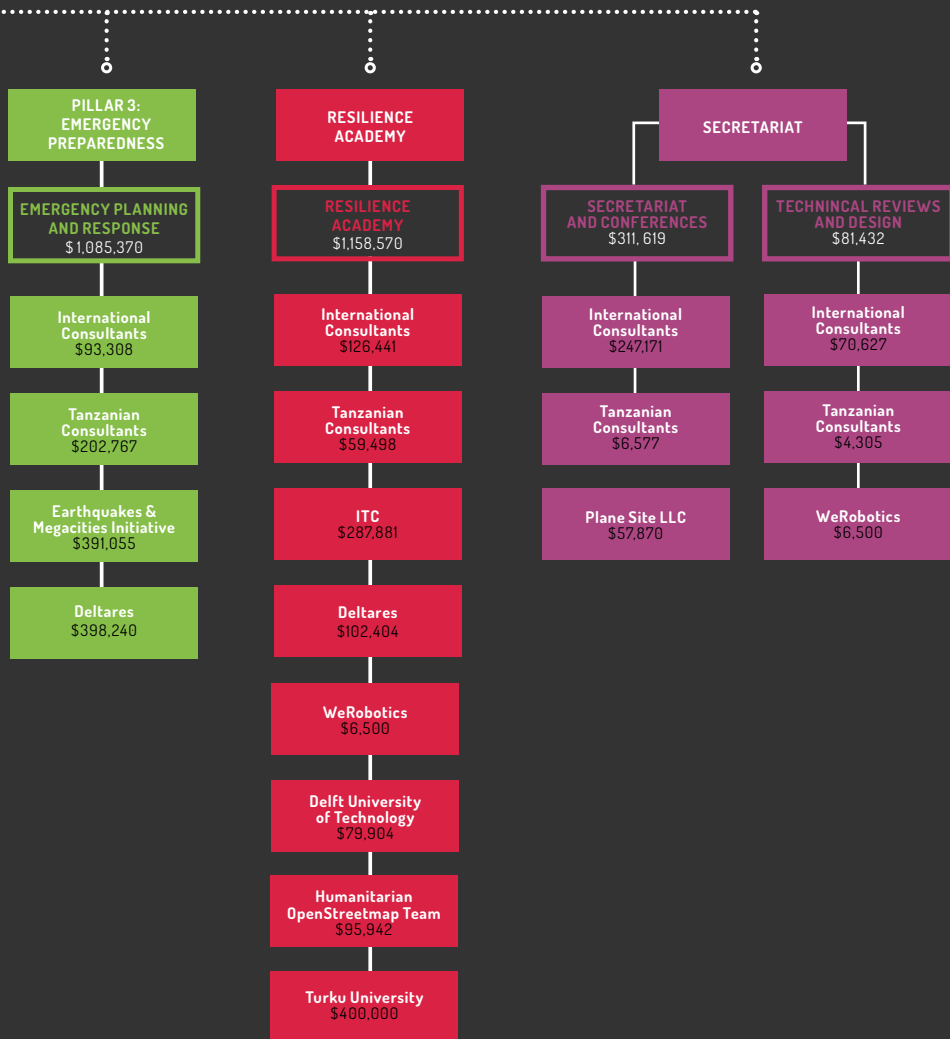
BETF ACTIVITY		TOTAL BUDGET ALLOCATED (USD)	FY 19 DISBURSED	COMMITTED	AVAILABLE	% DISBURSED + COMMITTED
Pillar 1 Risk Identification						
TF0A3559	Risk Evaluation and Information Management	\$4,330,000	\$1,148,000	\$860,000	\$810,000	81%
TF0A4139	Urban Exposure Mapping Data Services	\$150,000	\$0	\$0	\$0	100%
TOTAL PILLAR 1		\$4,480,000	\$1,148,000	\$860,000	\$810,000	
Pillar 2 Risk Reduction						
TF0A4691	Risk Mitigation Planning	\$1,210,000	\$628,000	\$217,979	\$0	100%
TF0A3571	Msimbazi River Revitalization	\$660,000	\$406,000	\$0	\$0	100%
TF0A4575	Urbanization Review - Resilience Planning	\$57,848	\$0	\$0	\$0	100%
TF0A5676	SWIFT Surveys on Poverty and Floods	\$190,000	\$12,000	\$0	\$0	100%
TOTAL PILLAR 2		\$1,927,848	\$1,034,000	\$133,000	\$0	
Pillar 3 Emergency Preparedness						
TF0A3828	Emergency Planning and Response	\$1,960,000	\$629,000	\$563,000	\$80,000	96%
TOTAL PILLAR 3		\$1,960,000	\$629,000	\$563,000	\$80,000	
Resilience Academy						
TF0A4238	Urban Resilience Academy	\$1,620,000	\$515,000	\$537,000	\$164,000	90%
TOTAL RESILIENCE ACADEMY		\$1,620,000	\$515,000	\$537,000	\$164,000	
Program Administration						
TF0A3742	Technical Review and Design	\$330,000	\$50,000	\$0	\$2,000	99%
TF0A2973	Secretariat and Conferences	\$1,130,000	\$446,000	\$25,000	\$75,000	93%
TOTAL ADMINISTRATION		\$1,460,000	\$496,000	\$25,000	\$77,000	
OVERALL TOTAL ACTIVITIES		\$11,637,848	\$3,822,000	\$2,118,000	\$1,131,000	90%



Delivery Chain

Indicates Fiscal Year to June 30, 2019







TANZANIA
URBAN RESILIENCE
PROGRAMME



WORLD BANK GROUP

